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UNIVERSITY OF ALBERTA

TEACHER IDENTIFICATION OF PHYSICALLY AWKWARD SCHOOL CHILDREN

by

JACQUELINE WEIR ©

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE

DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS STUDIES

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Date: July 13, 1992.

ABSTRACT

The major purpose of this study was to determine if regular elementary teachers could identify physically awkward students in their physical education classes. Two rating scales were designed to help teachers focus on the gross motor performance of their students; the Motor Performance Rating Scale (MPRS), and the Motor Development Rating Scale (MDRS). The MPRS was a short scale designed to be efficient yet economical of teacher time. There were two versions of the longer MDRS, one for grades 1-3 and another for 4-6 students. The identification procedure was implemented in six public elementary schools. The MPRS was completed for only those students, who according to their teachers, performed gross motor skills less well than the majority of their peers. In addition, the teachers rated a group of control subjects with the help of the MPRS. The MDRS was then completed for every child included in the study. A Gross Motor Competence Test battery was administered to 58 teacher-identified physically awkward children and 58 control students in grades 1-6. Twenty-four out of 27 of the teacher designated physically awkward students in grades 1-3 were classified as physically awkward (89%) according to the results of the motor tests and 26 out of 27 (96%) grades 1-3 control subjects were categorized as non-awkward. In grades 4-6, 65% or 20 out of 31 teacher-designated physically awkward subjects were classified as awkward and 30 (97%) out of 31 control subjects were classified as non-awkward according to the Gross Motor Competence Test. It was found that teacher-identified boys and girls differed in their performance of some gross motor behaviours, balance skills in particular.

Twice as many boys as girls were identified in grades 1-3 and the girls who were identified were definitely physically awkward. The performance of 7 out of the 15 teacher-identified girls in grades 4-6 was not in the awkward category according to the motor tests used. The rating scales were analysed to determine their relative efficiency for use in a screening procedure. The contents on both scales were judged to be valid by a group of 15 practising professionals. Measures of internal consistency indicated that the longer MDRS was the more reliable rating scale. The Gross Motor Competence Test was used as a criterion-reference to establish predictive validity of the rating scales. The MDRS was the more valid measure of motor competence when compared to the outcome of the motor tests. In summary it can be stated that regular teachers of elementary school who teach physical education did in fact identify physically awkward children in grades1-3 very well but they were less perceptive about motor incompetence in grades 4-6 students according to the Gross Motor Competence Test.

The Motor Development Rating Scale proved to be a valid and reliable instrument for teachers to use in a screening procedure as the first step in the identification of physically awkward school children. Recommendations were made concerning revision of this scale for future use by teachers. It was also recommended that more appropriate motor tests be developed for use in identification procedures with students in grades 4 and above. An important aspect uncovered in the current study points to the necessity of separating primary (grades 1-3) from junior (grades 4-6) school children for the purposes of identifying those who are physically awkward. Another important conclusion drawn was that different items on rating scales should be designed to identify boys and girls.

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The spark that ignited the writing of this document came from the enthusiasm of Ted Wall. Ted has a unique gift for generating excitement and promoting creativity in others. He promised (or threatened) to "change my life" and he has done that. The long-term support and forebearance of Jane Watkinson finally saw the project through to fruition. Thanks to you both. My entire commitee deserves credit for being on stand-by for so many years. Thank you.

Without the support of friends and colleagues however, I would not have been able to perservere. Perhaps the tenacity recquired is a prime example of the perseverance associated with awkwardness. A special thanks go to Barbara Paul and to room-mates Laurie Clifford and Henriette Groeneveld as well as my role model Jane Taylor, without whom my life would not have been changed. My thanks go also to the multi-cultural group, from Canada, England, Australia, Singapore and Red Deer, who helped to gather the data.

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I woud like to dedicate this study to the children who were involved in it with the hope that the children of tomorrow will reap some benefit form the work done here.

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CHAPTER I

INTRODUCTION

Children develop at very different and uneven rates and any child can encounter a problem in one phase or another of development. Because some children require exceptional resources to allow them the same opportunity to develop as other children have, it is essential to identify their special needs in order to direct the available resources to them. Many children with special educational needs are served by the programs offered within public school systems but the difficulties children might encounter in the motor domain are frequently ignored. Children with a syndrome of physical awkwardness require similar assistance through special programs in order to attain the usually expected motor competencies.

Physically awkward children have been described by Wall (1982) as "those children without known neuromuscular problems who fail to perform culturally-normative motor skills with acceptable proficiency." (p. 254). It is believed that remedial programs can help these children to improve their skills or at least to cope with their deficiencies (Cratty, 1984; Gordon & McKinlay, 1980; Wall & Taylor, 1984). Wall, Reid and Paton (1990) further state that "it is important to develop remedial strategies for their psycho-educational well being in order to alleviate the peer ridicule and professional disinterest", (p. 283) suffered by physically awkward children.

A child with an exceptionality, such as physical awkwardness, cannot totally escape the impact of his or her problem on other aspects of the school program. Many visible exceptionalities amongst school children, such as cerebral palsy, are presently being addressed through special programs in regular schools. These exceptionalities and other specific learning disabilities (SLD) in reading and/or mathematics are readily recognized by classroom teachers who adapt programs to suit the needs of such students and in addition provide these students with individual attention. On the other hand, an SLD in physical education does not have as high a profile as other commonly recognized learning disabilities in spite of the fact that motor impairment may be combined with other exceptionalities.

It is generally known that children with reading disabilities often have poor fine motor coordination sometimes combined with gross motor impairment. Taylor (1982) found 27.7 percent of a reading disabled group to have difficulties with gross motor activity whereas only 13 percent of the average readers in her study were physically awkward. Remedial programs usually focus on the reading problem and offer little or no help for children experiencing gross motor problems.

Little literature is directed to the elementary teacher of physical education concerning children who might benefit from extra tuition in the development of basic motor skills. Recognition of a syndrome of physical awkwardness, which could be classified as an

SLD in gross motor performance, is the first step in developing remedial programs which would help to alleviate the disability in gross motor performance. It has been noted by Gubbay (1978) that a simple recognition of the problem may reduce the social pressures felt by the physically awkward child. There has been no widespread focus on either identification or remedial programs for physically awkward children.

Nevertheless, the movement difficulties demonstrated by these physically awkward children are real and visible. They often have difficulties with scissors, shoelaces, balance, and general coordination. The problem is usually evident to the parents of pre-school children, but as long as children are not compared to their peers on a daily basis, their motor learning difficulties do not present a troublesome problem. At school entry, however, a child's inadequacies become obvious to others. Children quickly learn to avoid activities that produce stress. Since ineptness of movement is readily seen by others, the physically awkward child often withdraws from physical activity in the social setting. Not only does this result in social isolation, but there is an accompanying decrease in the fitness level of the child (Wall & Taylor, 1984; Paton, 1986). Continued lack of practice compounds the movement difficulties physically awkward children may have and they lag even further behind their peers in the acquisition of physical skills. Fast paced sports may never be within their reach.

Physically awkward children often fail to persist in the acquisition of basic skills like running, jumping, throwing, and catching. Just as basic academic skills like reading, writing, and arithmetic are essential for academic learning, so too are the basic physical skills essential for the development of recreational pursuits and physical fitness. Activities such as jogging, skiing, bowling, racquet games, team sports, and so forth are rooted in the basic skills of running, jumping, throwing, and catching.

While the development of certain physical skills is important culturally, it is also important to children's self-esteem. Motor incompetence has been linked to low self-esteem, (Cratty, 1984; Gubbay, 1975; Clifford, 1985; Causgrove, 1987) particularly in cultures that place a high value on physical prowess (Wall et al. 1990). It can be appreciated that failure to perform well in physical activities will negatively affect the self-confidence of a child. Motor competency was considered to be the only predictor of self-esteem among learning disabled children aged 7-12 in a study done by Doyle and Higginson (1984).

Poor performance in physical skills becomes a serious problem for children who cannot cope with their lack of skill. Some children may be able to compensate with successes in other endeavours. Others may compensate in devious ways, for instance, "to act the fool as a cover in order that others may think he [or she] is not really trying his [or her] best." (Gubbay, 1975, p. 44). Self-deprecation or avoidance often leads to a cluster of behaviours characterized by social isolation, low self-esteem, lack of motivation, and behavioural difficulties such as aggression (Wall &

Taylor, 1984). This cluster of behaviours is characteristic of a syndrome of physical awkwardness.

If procedures to recognize the problem of motor impairment were widely accepted in elementary schools then children identified as physically awkward might be helped with a minimum of special assistance in their physical education classes or perhaps with parental help outside the school situation. Some might benefit from withdrawal for specialized physical education instruction, while others might wish to take advantage of the extra tuition offered by a motor development clinic such as the one established at the University of Alberta. Children who have been referred to the Motor Development Clinic at the University of Alberta have usually been identified as having severe motor difficulties that interfere with their academic progress, their social interactions, and their general development.

The need to provide the above mentioned services within the educational system for children with all types of learning disabilities has in recent years been emphasized by legislation at the local and federal levels of governments throughout the world. Legislation such as The Education for All Handicapped Act (1977) with its accompanying regulations emphasizes individual education plans in the U.S.A. Legislation promoting the integration of children with special needs in the U.K. is based on the Warnock Report from the Committee of Enquiry into the Education of Handicapped Children and Young People (1978). In Canada, there have been amendments to the Education Acts in most provinces concerning integration and individual attention for all students, such as Bill 82 (1980) in Ontario. In light of these progressive changes, a reliable screening procedure for the identification of children experiencing motor problems becomes essential.

At present there are few jurisdictions offering remedial programs in motor development such as the Gross Motor Program found in the Winnipeg Public School Board in Manitoba. The program in Winnipeg is part of an early identification program in which children are screened at school entry in order to identify learning problems. The children are screened by physical educators in the area of gross motor skills and individual programs designed for physically awkward children are implemented within the schools. There is some promise of the development of remedial programs elsewhere stemming from the new curriculae being written across Canada recommending that children be offered physical education programs that account for individual differences. In many States in the U.S.A. individualised educational programs (IEP) are being devised for children with special problems which includes motor problems in physical education. There is a paucity of empirical documentation of these pioneering programs but the first step in developing remedial programs should be to establish reliable identification procedures.

The ideal situation is described by Gordon and McKinlay (1980) with their recommendation for pre-school screening. They state that " it is not enough to detect such children at an early age; we must be able to offer remedial programs . . . in the child's home town and, if possible, in his own school." (p. 31).

The benefits of early identification are obvious on the basis of prevention of a syndrome being better than learning to cope in later years. While early identification and remediation would help young children to acquire competence in many basic motor skills, physical awkwardness could arise later in a child's life as the cultural demands for more complicated movement patterns produce stressful situations that are difficult for some children to handle. In this case a practice deficit due to avoidance might lead to a moderate physical awkwardness. Moreover, acquired knowledge about action is domain specific (Wall, 1986). For example, early and concerted practice can produce a superb hockey player with minimal acquired skill in other physical activities. The complexity of an activity can also affect the acquisition of physical skills. One can be adept at the simple skills needed to play dodgeball but have difficulty learning the more complex skills needed for team sports like basketball or baseball. Henderson and Hall (1982) suggested that the nature of awkwardness might change with age. It is possible that intervention in the form of remediation or counselling could be needed by the older schoolchild who begins to lag behind peers even though he or she appeared quite competent at school entry. A method of identifying older children with moderate problems must be considered.

In discussing identification we should examine the extent of the problem. The incidence of physically awkward children has been cited at different levels by different researchers. McMath (1980) in a review of the literature suggests a "prevalence of severe clumsiness of about 5% and of moderate clumsiness of some 15%" (p.57).

Research has shown that teachers are quite perceptive about the motor performance levels of their students and that teachers play a vital role in the initial screening and assessment of their students' motor performance (Todd, 1988). The present study is aimed at establishing a screening procedure that teachers can use to identify those children who are physically awkward.

The rating scales used in this study evolved from the Teacher Rating Scales designed by Umansky (1983) who was one of the first to focus on culturally-normative skills in the assessment of physically awkward children. Wall (1982) has said that the use of culturally-normative tasks to assess performance is crucial to the identification of physically awkward children. Wall and Taylor (1984) describe culturally-normative skills as "those that are generally used within a specific culture at certain ages by the majority of people" (p. 159). Thus the use of such tasks was of prime concern in designing the rating scales to be used in the current study.

In addition to play skills that are common to a specific culture, movement competence is an important element in determining whether a child will be physically active by choice. A child usually chooses to engage in activities in which he or she feels successful. Movement competence and confidence are important elements of a person's participation in physical activities according to Griffin and Keogh (1982). They elaborate these elements (Griffin & Keogh, 1982) saying that the sensory experience gained from motor activity has a definite influence on participation. For example, when individuals experience exhilaration, joy, and mastery, it should motivate them to reproduce these feelings, but if pain, sweat, and fear of injury, are the results of activity, they may avoid participation. If a person feels positive about motor activity, it will likely be approached with intensity and persistence. Conversely, it is to be expected that negative feelings about movement will result in a reluctant participant with a low level of persistence. One can also expect that the social situation might adversely influence the movement confidence of a performer who anticipates criticism or scorn from peers and onlookers. Both the confidence and the competence aspects of movement seem to be important in assessing the performance of physical skills. Teachers in regular physical education classes are in a position to observe the movement confidence displayed by their students from a broader perspective than the researcher who administers motor tests to measure movement competence. A rating scale that asks questions about culturally-normative skills and also includes items about movement confidence should facilitate the discrimination of physically awkward children from their more adept peers. In addition, the answers to such questions could produce comprehensive information for designing individual remedial physical education programs once identification is established.

Rating scales should also account for the progressive nature of skill development. Wall (1982) stated that the development of complex physical skills is characterized by increases in spatial and temporal uncertainty that requires the use of prediction and other strategic behaviours on the part of the participant. Smith (1988) agreed with Wall's statement and outlined how physical skills develop from simple skills, through reactive skills, to complex skills that require the participant to apply strategic or predictive knowledge to more challenging activities. As a child matures, the level of participation becomes more complex because older children are expected to play more intricate games or sports and most do prefer the challenge of complex activities. A rating scale designed to discriminate physically awkward children from their more adept peers should reflect this developmental continuum in the acquisition of physical skills and thus items about complex skills should be included in scales designed for older children.

The intent of the current study is to incorporate all of the above concerns: culturally-normative skills, confidence in performance, motor competence, and developmental differences into the design of a rating scale that teachers can use to identify physically awkward children within a normal school population. The prime concern is to devise items aimed at gross motor skill behaviour exclusively.

Without a reliable means of identification there is no point in devising remedial programs for children who lag behind their peers in motor skill development. A pilot study was conducted in 1985/86 within the Edmonton Public School jurisdiction to identify, instruct, pand counsel, physically awkward children. The short rating scale was field-tested in this pilot study and revised as recommended for the current study. An outline of the pilot study can be seen in Appendix E. The Motor development Rating Scale was designed specifically for the present study as outlined in the Methods (p. 66).

Statement of the Problem

The central question of this research project is : can regular teachers of elementary school accurately identify children in their physical education classes who are physically awkward in accordance with the best currently available motor tests?

The Gross Motor Competence Test (Appendix C) was used as a standard against which to measure the teachers' identification decisions. This battery of motor tests included twelve items selected from three valid and reliable assessment instruments intended to measure gross motor performance. Seven sub-tests were derived from the Stott, Moyes and Henderson Test of Motor Impairment (1972), one from the work of Gubbay (1975) and four from the Canada Fitness Awards (1984). Norms used for the fitness tests were validated with children across Canada and the percentile norms for the eight other sub-tests were established over a four year period on a sample of Edmonton school children (Taylor, 1982; Taylor, Smith, Squair & Wall, 1984; Taylor, 1985). Two sub-problems stem from the initial question.

Sub-problems

1. Do rating scales assist teachers in the identification procedure? Specifically, does the Motor Performance Rating Scale help teachers in the identification process and does the more detailed Motor Development Rating Scale help teachers to more accurately identify physically awkward children in their classes as measured by their performance on the Gross Motor Competence test?

2. Do male and female students, who are teacher-identified as physically awkward, perform gross motor skills differently ?

The Motor Performance Rating Scale (MPRS, Appendix A) was intended to help teachers focus on simple overt and easily observable gross motor behaviours that might be seen in the gymnasium or on the playground. The scale contained only ten items which asked the teachers to rate their students' motor skill behaviours as compared to the motor skills of their classmates.

The Motor Development Rating Scale (MDRS, Appendix B) was used by the same teachers to rate their observations about the motor performance of the same sample of school children. The items on the MDRS provided more detailed information about the students' motor development levels than that derived from the shorter MPRS. The items on the MDRS were arranged in a developmental sequence with simple skills like running, catching and throwing at the beginning. Items about reactive and complex skills were listed at the end of the scale. This longer scale (MDRS) was divided into two different levels; one to screen Kindergarten to grade three children and another for students in grades 4-6 (Appendix B). The two levels have different items allowing for the different curriculum demands made of children in these grades while at the same time accommodating the cultural demand that students learn more complex skills in physical education classes as they progress through school. Curricular and cultural demands are different for these two age groups and it is also possible that teacher expectations may differ for boys and girls.

Delimitations

The sample was drawn from six regular elementary schools in different areas of Edmonton. In a two-step screening procedure the teachers of physical education in these schools completed a short MPRS for children whose motor development concerned them. It was at this time that a control group of matched subjects was chosen from the same grades as the identified children. The control group was matched for grade, sex and age-in-months with the experimental group. The teachers of physical education then completed the MPRS for each child in the control group.

The second more detailed MDRS was completed after a second training session with the teachers at the schools involved. Using the MDRS the teachers then observed and rated the experimental and control subjects in their physical education classes on all 24 items concerning specific skills in gymnastics, games and general movement.

In one school there were a number of classes for children with multiple learning problems. It was decided, however, that children who were already classified as developmentally handicapped or assigned to special education classes would not be included in the total numbers nor in the statistical analysis. Eliminating these three subjects and their controls left an initial total of 76 physically awkward and 73 controls in this study. All of the children whose parents consented to their assessment were included in the testing program but only the data from the teacher-identified students with matching control subjects were used for the final analysis. The number of subjects whose scores were used for this study was 58 children from regular classes identified as physically awkward by their teachers and 58 control subjects matched with the experimental subjects for grade, sex, and age-in-months.

The results of motor tests used for the 5 and 6-year-olds would not easily compare with the scores of the subjects over the age of 83 months because the motor tests include fewer sub-tests for the younger chilren. Specifically, 9 tests are designed for five and six-year-olds, while 12 tests were completed by children older than 83 months. Only 8 possibly physically awkward children under the age of 84 months were identified and assessed. There were 10 control children in this age group whose parents consented to their participation. This group was too small to make valid comparisons and implications cannot be drawn from so small a sample. No statistical analysis was completed for the scores of these children in the evaluation procedures.

Limitations

A limiting factor is imposed by the fact that parental permission is required before children's motor performance can be assessed by researchers. Eighty-one percent of the parents of the identified children granted permission for the subsequent motor testing and 75% of the control group's parents agreed to let their children participate. This condition limited the numbers of subjects included in the study. In one of the six schools involved the study only the kindergarten to grade 3 students were screened placing a limitation on the number of older students screened.

The definition of physically awkward children used in this study is based on the notion that there is no known neuromuscular problems. Since the technical and economic resources to assess neuromuscular problems were not available it was presumed for this study that children who are mainstreamed, are not withdrawn from regular classes for academic remediation, and who do not have obvious physical handicaps will be without known neuromuscular problems. This presumption may limit the outcomes of this study.

There is also a possible limitation due to the fact that two similar rating scales were used in the screening process. Two orientation sessions, one for each rating scale, helped the teachers to focus on gross motor behaviour for a longer period of time than can be expected if only one rating scale were to be used in future screening procedures.

Definition

Physically awkward children referred to in this study are those children from normal elementary school classes who fail to perform culturally-normative motor skills with acceptable proficiency as determined by teacher identification using the Motor Development Rating Scale, the Motor Performance Rating Scale, and by the results of a Gross Motor Competence Test battery including selected Canada Fitness Awards tasks (1984). The key to categorizing children as physically awkward is the concern expressed by regular teachers about their students' motor development observed during physical education classes.

This study focuses on children who have gross motor problems specifically. Many physically awkward children have difficulties with both fine and gross motor activity while some children have difficulties with fine motor activity exclusively. It was believed that the screening of physically awkward children would be facilitated by concentrating on physical education and fitness. This focus could ultimately lead to the creation of special physical education programs to improve basic gross and fine motor skills and to alleviate the concommittant problems associated with a syndrome of physical awkwardness.

CHAPTER II

REVIEW OF LITERATURE

Physical Awkwardness

Physically awkward children are those children whose performances reflect inadequate attempts to perform certain motor skills which can be regarded as being essential for a normal life or at least culturally desirable (Morris & Whiting, 1971). Wall (1982) adds the condition, "without known neuromuscular problems" (p.254) to this definition. This statement of Wall's places physically awkward children, whose only exceptionality is poor motor performance, within the normal population of school children.

Acceptable proficiency in motor performance varies, of course, with age, sex, and the socio-cultural background of a child. Wall (1982) also emphasized that the adequate performance of culturally-normative skills is crucial to acceptable motor proficiency Culturally-normative skills are those that are generally acquired by a majority of children at certain ages within a specific culture. For example, a child in Canada is expected to learn to ice-skate at a very early age while a child growing up in Brazil will likely learn to play soccer at an equally early age. It should be noted that boys and girls are oriented toward different sports in different cultures. Indeed, different cultures require different levels of physical activity from boys than from girls (Clifford, 1985). Despite cultural expectations, the underlying premise about acquiring motor skills is that children's proficiency should increase proportionately with age and will reflect the increasing complexity of their sport, social, and intellectual environment.

Proficiency in certain sport and play skills has more value in some cultural environments than in others and within every cultural environment the value of different sport skills changes as children mature and their social contacts are expanded. In addition, the demand for age-appropriate sport skills is emphasized by the school curriculum so children are expected to constantly change their perception of their own capabilities as they learn new and more complex play or sport skills. Learning physical skills requires considerable practice time and if that time is insufficient, children will be unable to acquire the age-appropriate and culturally-normal skills expected of them within the context of their specific environment.

Children learn physical skills in a sequential manner and are expected to demonstrate a progression from simple to more complicated motor behaviour. Basic movement is a prerequisite for more complex motor patterns. Wall (1985) explains the developmental nature of skill aquisition in his discussion of a skill continuum in which children first learn the simple skills such as walking, running, jumping, swimming, and other response-loaded behaviours demanding kinematic control. The simple skills are individually initiated movements. Children act upon their environment to gain information about how that action affects both themselves and their surroundings. Reactive skills, at the next level of motor development, require an individual to perceive an object in the environment and react to it or to act upon it (Wall,1985). This includes activities such as bouncing, kicking, catching a ball or hitting a ball or puck, with a club, bat, stick, and so on. Wall (1985) said that reactive skills are perceptually-loaded. At this level of performance other players in a game become a part of the external environment. Reactive skills require participants to perceive and react to teammates and opponents in addition to the game equipment. Wall (1985) claimed that complex skills require the synthesis of the above basic skills into more cognitively-loaded behaviours in sport such as, intercepting a pass, the precise timing of a drop shot, making a double play, and other such strategic moves used in sport. The main emphasis in the complex skills is the making of action decisions prior to the execution of a movement. This continuum of skill development infers an improvement in physical skills with concentrated practice.

Barclay and Newell (1980) examined this underlying premise of expected skill improvement and noted that children use response outcome information with increasing efficiency as they grow older. They suggest that the ability to process information more rapidly and adaptively may be a product of repeated experiences over extended time rather than a product of maturity. They emphasized that the key to children's apparent efficiency in motor skills as they mature is their developing ability to evaluate feedback from multiple motor learning trials. Physically awkward children however, experience frequent failure in attempting to learn physical skills and thus develop an avoidance mechanism leading to fewer opportunities to evaluate feedback from motor learning trials. These children become comparatively less efficient with age and less able to cope with culturally-normative physical activity situations. The accumulation of unsuccessful experiences ultimately establishes a fairly stable negative self-image in relation to physical activities (Wall & Taylor, 1984).

A surprisingly large number of children appear to exhibit the symptoms of physical awkwardness. The incidence of physical awkwardness has been estimated at anywhere between 5% (Gubbay, 1975) and 15% (McMath, 1980) of the total school population. In 1967 Brenner et al. surveyed 810 eight and nine-year-old regular school children identifying 6.7% as being "visuo-motor" disabled. In 1968 Keogh, using a six item test battery for boys only, found 7% of normal school boys were severely awkward and another 13% had moderate problems with motor performance. In 1975 Gubbay found 6.1% of 919 children between the ages of eight and twelve to be "clumsy". In 1982 Henderson and Hall used teacher input to identify children who were having severe difficulties with motor performance in an Infant School in the U.K. Sixteen children out of a population of 400 were identified in their study. Taylor (1982) administered motor tests to 280 Edmonton school children and found that 13% of regular school children were physically awkward. In the above mentioned studies, those that included both boys and girls aged 8-12, found almost as many girls as boys to be affected by physical awkwardness.

What is striking about these studies is that a large number of children were identified as physically awkward. There appears to be a higher percentage of school children affected by a lag in gross motor development than by any other developmental disability. A disability of such proportions would seem to deserve serious consideration by the educational system.

The first step within the educational system would be to establish a screening and identification process. Without identification there would be little hope of helping physically awkward children to improve their motor performance. A process which involves teachers as part of a broader program of screening, identification, and remediation, requires a sound basis in theory; therefore, a theoretical basis of motor skill development and its implications for the physically awkward will now be discussed from an educational perspective.

An Educational View of Skill Development In Children

The acquisition of motor skills in children must be examined from a developmental perspective because of the rapid physical and cognitive changes seen in children as they grow and progress through the educational system. Children do not proceed lock-step from one milestone to another in the journey from infancy to maturity in spite of the fact that stages and age-related characteristics can be recognized during the process (Espenschade & Eckert, 1980;

Illingworth, 1980). Nor does the child develop in the sense of a rosebud unfolding in which all of the petals are preformed. Development is more of an evolution in which an individual selects the most useful responses and behaviours to adapt effectively to his or her particular econiche. Because adaptation is so varied, this personal evolution results in a multitude of individual differences. The development of motor skills reflects this variability.

The evolutionary process of motor skills begins early in life, in fact, movement begins when life begins. White's (1959) model of effectance motivation implies that infants seek competence in dealing with their environment and Piaget (1952) stated that the primary competence infants seek is in the sensori-motor domain. Consequently, motor competence or incompetence is shaped by and evolves with, early experience in the motor domain. Bernstein's (1967) comments on the development of motor skills aptly describes this evolutionary perspective:

> Over the course of ontogenesis each encounter of a particular individual with the surrounding environment, with condition requiring the solution of a motor problem, results in a development (sometimes a very valuable one) in its nervous system of increasingly reliable and accurate ***objective representations*** of the external world, both in terms of the perception and comprehension involved in meeting the situation and in terms of projecting and controlling the

> realization of the movements adequate to this situation (p.119).

Thus we see the evolution of motor skills is peculiar to individuals as they adapt to the movement requirements within their immediate and individual environment. As children absorb and organize information about their external world, each child lays down a particular knowledge base about motor skills (Wall, A.E., McClemments, J., Bouffard, M., Findlay, H., & Taylor, M. J., 1985). Although there are definite similarities to peers within a culture, every person encounters a slightly different environment.

Environment alone does not propel evolution. Heredity also helps to determine the variability in adaptation that occurs in individual evolution. Wall (1982) accounts for the influence of heredity in individual differences by stating that motor development is the result of an interaction of both genetic and experiential factors. Hence, individuals can be seen to develop in the motor domain according to their past and ongoing experiences and also within the organic constraints of their particular heredity. It can be concluded that the advancing developmental stages as observed by researchers in the past (Gesell, 1966; Espenschade & Eckert, 1980; Holt, 1977) are not solely a function of ages and stages of maturity. Experience plays a vital role in the development and the acquisition of physical skills.

Identification of this group of children has been approached from many perspectives. Yet, whether the approach is from a maturational delay theory (Illingworth, 1980; Gordon & McKinlay, 1980), a deficit hypothesis (Gubbay,1975; Henderson & Stott, 1977), or the information processing theory (Morris & Whiting, 1971), an efficient screening device that teachers could use to quickly identify physically awkward children has not yet evolved.

Recent recommendations by those interested in skill acquisition suggest that we take a multi-dimensional approach in order to better understand skilled performance (Higgins, 1982; Whiting, 1982). An information processing approach to the discussion of skilled performance no longer covers the total picture. Its focus on the process of learning ignores the acquired knowledge of individuals. In her discussion of skilled behaviour Allard (1982) declares, that the concept of an individual is not just a "collection of information processing components that must get glued together for skilled performance" (p. 22) but that acquired knowledge and past experience is the major difference between expert and novice performers in the motor skill domain. She also asserts that knowledge is not exclusively procedural because skilled performers "require both feet and head" (p. 26).

In accordance with Allard's (1982) assertion of a cognitive contribution to skilled performance, Newell and Barclay (1982) state that knowledge and action are intimately related. If this is true, it follows that motor skill development requires more than an increase in strength or size. Increased cognitive processes are intricately woven into the skill acquisition process. In the past, the growth of memory and the application of strategies to movement problems were attributed to the increased size of the brain. It is logical that increased capacity should increase potential but there appears to be an actual neuronal growth in the brain due to experience according to Prechtl (1981) and Bornstein (1979), who both report that neural pathways are laid down because of exposure to sensory and motor exeriences in early life. Inhibited growth in neuronal pathways can also occur due to experience as Pick (1980) demonstrated in experiments with kittens whose eyesight did not develop through disuse. In other words, experience can direct and change the potential of a growing individual's neural pathways thus influencing his or her cognitive capacities. Since cognitive capacity is an integral component of motor competence it can be stated that prior experience influences the development of physical skills. Along these same lines Barclay and Newell (1980), as stated earlier, attribute the growth of knowledge and strategy application observed in children to an accumulation of motor experiences rather than to the traditionally held view of increasing capacity with increasing age. Wall, et al. (1985) expand this viewpoint in a meta-theoretical paper with the underlying premise that, "past conceptual models of motor development have usually been concerned with age-related changes in motor performance rather than the cumulative development of motor skill over time" (p. 21) pinpointing prior experience as a precursor to skilled performance.

Wall, et al. (1985) in their knowledge-based approach to motor development synthesize the characteristics of skilled action and increased developmental capacities to conclude that the quality of motor development is determined by the knowledge a person has acquired through experience. They divide this knowledge about action into three major categories of knowledge; procedural, declarative, and affective. These three types of knowledge interact to form a knowledge-base that is built through countless learning experiences. The three knowledge bases as outlined by Wall and his colleagues (1985) will now be looked at in turn.

Procedural Knowledge

Procedural knowledge about action is simply knowing how to perform an action. This knowledge about action is acquired through practice which depends on both the quantity and the quality of that practice. Learning how to perform movements requires the integration of the perceptual, cognitive, response initiation, and execution phases of action (Singer, 1980). With focused practice a person progresses from novice to expert by repeating an action often enough for all the phases of the movement to flow smoothly together. Efficient practice also permits an individual to monitor and assess motor performance with each repetition until mastery is attained. When a skill is practised enough to become automatic, it no longer requires attentional control although a trouble-shooting awareness is maintained in case of unexpected emergencies (Norman & Shallice, 1980). In this manner motor knowledge is organized over time through mental and physical practice into action schemas. The execution of actions depends on applying the accumulated knowledge, or schemas, to the task at hand. These accumulated schemas constitute procedural knowledge about action that is gained while learning physical skills. Procedural knowledge allows for novel responses to be built on previously learned skills. Individuals assess their own capabilities with feedback from every response they make and thus learn what actions they, personally, are capable of initiating in a given situation. As developing children are gaining this procedural knowledge they also gain declarative knowledge about action.

Declarative Knowledge

Declarative knowledge about action is the factual information stored in memory that influences the development and execution of skills. With experience, children expand their concepts about action and use this knowledge to control their motor behaviours and to manipulate the objects with which they play. While the play and movement patterns of children become more complex they continue to classify information and to develop an understanding of their own capabilities in the motor domain. The acquisition of language plays an important role in the control of movement and helps to build cognitive bridges between movement experiences. This in turn focuses the application of previously learned skills to the task at hand and facilitates adaptation to novel experiences. Language transforms procedural knowledge into mental images allowing for optimal learning in the motor domain. Thus, as children accumulate declarative knowledge they can listen to verbal instructions and then apply their procedural knowledge to action. Expertise in a specific domain influences the learning of a given task because the expert will cue into new information based on his or her existing knowledge about the activity (Wall, 1986). Skillful participants therefore, use declarative knowledge to grasp relationships between common skills in games or sports enabling them to learn new sports more quickly than people who lack cumulative experience in motor skills.

Closely associated with these two types of knowledge is metacognitive knowledge, which, simply put, is knowing what you know. An individual learns what he or she can accomplish and the limits of his or her performance through countless trials at a variety of actions and sequences of movements and then applies the metacognitive knowledge thus acquired to the demands of each new situation requiring a physical response. Knowing their own capabilities in sport or play situations is important to children during their school years because physical skill is held in such high esteem by their peers. The metacognitive knowledge a youngster has acquired will therefore influence the physical activities he or she pursues. In fast-paced sports the quick decision making that is required also depends on the accumulated metacognitive knowledge and limits the activity of adolescents who recognize they have not acquired the complex skill required.

Metacognitive skills are gained as motor behaviours are learned and these skills are more closely associated with procedural knowledge. Metacognitive skills refer to the attack skills people use in learning new motor activity. These skills allow participants to focus on each sequence of a skill and to guide their control of action until all the required movements flow easily together. Planning, monitoring, and adapting movement is facilitated by this body of metacognitive knowledge and skills accumulated through a multitude of movement experiences over many years.

Affective Knowledge

The third type of knowledge about action is in the affective domain. As children learn procedural and declarative knowledge they attach either positive or negative feelings to their actions. Successful experiences generate feelings of competence creating positive self-esteem (Harter, 1978). Children who continually face failure avoid repeating experiences that reduce their self-esteem. If they are forced by social pressures or the demands of the school curriculum to perform in culturally-normal situations and they continue to receive negative feedback, they may well develop a syndrome of behaviours characterized by a lack of confidence, minimal persistence, and little motivation to engage in physical activity (Wall & Taylor, 1984).

Negative feelings about actions affect the motivational state of the learner. This in turn affects the acquisition of procedural and declarative knowledge about action. It is difficult to motivate an individual who has acquired a large body of affective knowledge about action registering incompetence, pain or embarassment.

The emphasis on learning and experience in this theoretical base presented by Wall, et al. (1985) lends an educational perspective to motor skill acquisition which in turn underscores the heavy responsibility teachers bear in providing opportunities for children to accommodate and assimilate movement information in order to improve their skills. This theoretical perspective also indicates that the acquisition of a body of knowledge about movement is integral to transferring skills to novel movements and new game situations that become more complex with increasing age and cultural demands. Rather than maturing and becoming more adept simply through physical growth, children develop in an evolutionary manner as they adapt to the physical demands in their environment and accumulate these three types of knowledge about action. The main prerequisite to the development of physical skills is having sufficient opportunity to practise a variety of movements. Much of the opportunity to learn and practise motor skills is provided for children by the school system. With its emphasis on learning and experience, Wall, et al.'s (1985) approach to understanding motor development also outlines the plight of the physically awkward child in terms to which teachers can relate. The application of these three types of knowledge to the remediation of physically awkward children serves to give us an holistic view of motor development on which to base the goals and objectives of an intervention program designed for these children within the educational system.

In examining Wall's (1985) and Smith's (1988) notion of the developmental nature of physical skills we can see that their ideas fit the acquisition of these three types of knowledge about action. Procedural knowledge is needed first for response skills and then is an essential part of reactive behaviours necessary for ball skills while later being drawn on for decision-making in more complex skills. As children move along the skill building continuum and increase their knowledge about particular actions the procedures are practised and adapted to each higher level of skill sought by the participant or demanded by the environment. Declarative knowledge begins with knowing about spatial relations and a sense of one's own body image that is absorbed while learning simple skills. Language skills seem to be embedded in experience and the learner increases his or her language skills at the same time as acquiring simple motor skills. The resultant increase in language links experience to declarative knowledge about action. Declarative knowledge continues to expand as more complex tasks are attempted. A child can make statements concerning his or her feelings about action as declarative knowledge increases thus building a body of knowledge about action in the affective domain. Affective knowledge, either positive or negative, is accumulated and expressed with each level of skill a child attempts while trying to develop movement skills.

The education of children truly follows an evolutionary process and it is realized that some children do not have the same opportunity to adapt to their changing environment as efficiently as others. It is those children who lag behind their peers who are in need of help. Identification is the first step in offering help.

Physically Awkward Children and Skill Development

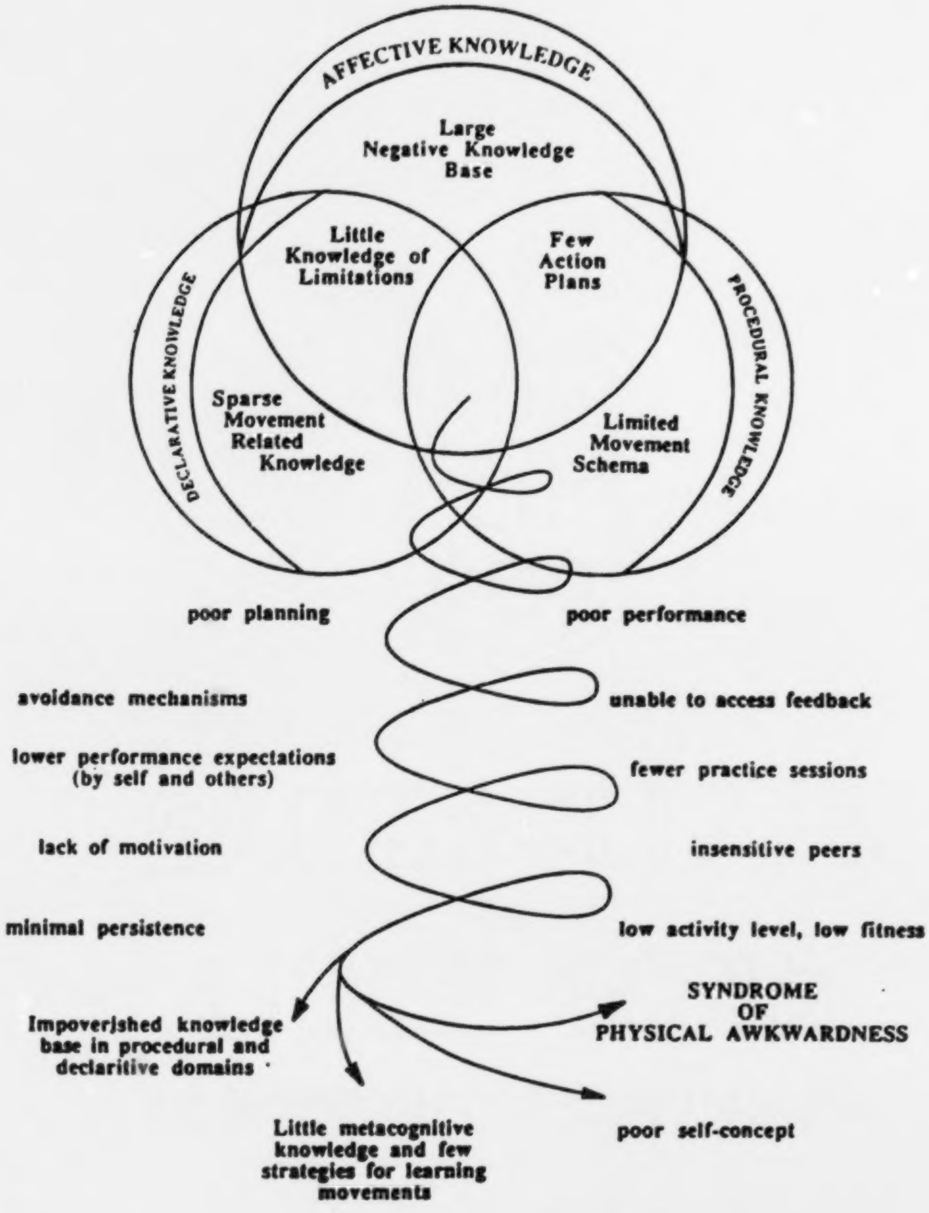
Physically awkward children are characterized by their lack of information in the realm of procedural and declarative knowledge but the affective knowledge base they possess is comprised of mostly negative information that requires considerable retraining (Wall & Taylor, 1984). Physically awkward children accumulate negative feelings because of their inablility to perform physical skills with the same competence as their peers. It may be very difficult to overcome this aspect of the syndrome. Viewing affective knowledge as acquired knowledge indicates that we should be able to build an alternative knowledge base through remedial programs which offer a chance for success in some area of motor performance.

Careful planning for successful experiences is therefore a priority when devising programs intended to remediate physical awkwardness. It is essential to match the nature and difficulty of tasks to the level of observed achievement in order to ensure success for the child (Smith, 1977). Smith (1977) presents details for simplifying skills that let the learner feel in control rather than feel relatively helpless when standards for physical skills seem too high. Smith's (1977) task analysis method can be applied to programs for children with movement difficulties. Physically awkward children feel incapable of even attempting to perform when standards appear unattainable to them but if tasks are simplified, a learner can focus on clear goals that seem to be within reach. Task analysis allows for a smooth evolution from simple to complex performance providing the performer with a comfortable situation in which to acquire knowledge about action. Continual assessment of motor performance in which augmented feedback is made available to the learner should increase a child's awareness to the point where he or she can recognize his or her own success and thus build a more positive affective knowledge base that will encourage further attempts at physical skills.

Another problem presented by physically awkward children is that they do not recognize the level of task complexity due to insufficient procedural knowledge. The professional must assess the present level of performance and then design suitable remedial activity to increase the child's procedural knowledge. It is essential to know what the child can and cannot do in order to provide an opportunity for increasing that knowledge.

Many physically awkward children have a limited vocabulary for movement and often do not seem to understand action commands (Taylor & Clifford, 1985). Declarative knowledge must be presented along with skill instruction to expand not only the concepts about action but also the cognitive aspects of motor behaviours. Mental rehearsal may assist in the internalization of declarative knowledge and should be an integral component of remedial programs.

A model to illustrate the knowledge base that a physically awkward child has amassed through experience is presented in Figure 1. This model illustrates the cyclical fashion in which a syndrome of physical awkwardness may develop as a child matures and interacts with his or her own particular environment. The model also


AFFECTIVE KNOWLEDGE
Large Negative Knowledge Base
DECLARATIVE KNOWLEDGE
PROCEDURAL KNOWLEDGE
Little Knowledge of Limitations
Few Action Plans
Sparse Movement Related Knowledge
Limited Movement Schema
poor planning
poor performance
avoidance mechanisms
unable to access feedback
lower performance expectations (by self and others)
fewer practice sessions
lack of motivation
insensitive peers
minimal persistence
low activity level, low fitness
SYNDROME OF PHYSICAL AWKWARDNESS
Impoverished knowledge base in procedural and declaritive domains
Little metacognitive knowledge and few strategies for learning movements
poor self-concept

knowledge of action, or the lack of it, is accumulated in a cyclical fashion leading to a Syndrome of Physical Awkwardness.

Figure 1. Knowledge of action leading to a syndrome of physical awkwardness.

indicates how feedback from attempted motor activity can result in a small body of knowledge about action and at the same time it can increase the body of negative affective knowledge which leads to the cluster of behaviours known as a syndrome of physical awkwardness. The model emphasizes the need for assessing and evaluating the background knowledge a child has acquired through experience. Acquired knowledge must be examined in order to design remedial programs that are based on more than the results of discrete motor skill tests. A summary of the knowledge bases children have attained offers teachers detailed information on which to build programs to help students accumulate more knowledge about action. Of course, the first step in helping students is to identify the ones who would benefit from detailed motor assessment.

Teachers in the Identification Process

Gordon & McKinlay (1980) assert that physically awkward children should be identified early in their school career and that, "The infant teacher is probably the key person" (p. 31) in screening children who are lagging in motor development. The need for early identification is underlined by the fact that physically awkward children can be wrongfully labelled as lazy, unmotivated, or dull in school (Gubbay,1975) There is widespread agreement that children's school careers and emotional health would benefit from the early recognition of physical awkwardness through teacher assessment followed by remedial strategies to alleviate the possible concomitant problems (Gubbay,1975; Keogh, et al.,1979; Gordon & McKinlay, 1980).

Gallahue (1983) asserts that the motor performance of young children is inconsistent. He indicated (1983) that gross motor behaviour that is more closely representative of a child's skill level can best be identified by working with a child over a longer period of time. The child's own teacher would, in that case, be in the best position to judge the motor performance of his or her students. There is some indication, as reported by Sugden (1972), Gubbay (1975), Keogh (1977), and Henderson & Hall (1982), that teachers can identify physically awkward children in the school system. However, elementary school teachers seem to be reluctant to make judgements about the motor development of their students (Clifford, 1985) in spite of their familiarity and their concern for the total development of the children in their classes. Primary teachers in the U.K. also communicated their initial misgivings about assessing the motor skills of children (Henderson & Hall, 1982). Nevertheless, teachers have been shown to possess a "practical knowledge" (Elbaz, 1983) about student behaviour gained through experience in the classroom and in observations of large numbers of children. Since teachers are dedicated to the cognitive, social, and physical development of the children in their charge they should indeed develop skills in the observation of motor behaviours. A screening procedure using a rating scale would tap this practical knowledge that teachers have absorbed about their students and at the same time encourage them to concentrate their powers of observation on motor development.

Few primary or junior division (divisions 1 & 2) teachers in Canada are specialists in physical education (Watkinson & Bentz, 1985). Nevertheless, teachers bear the responsibility for following the curriculum for a large number of disciplines, one of which is physical education. The concern teachers have for the holistic development of children is reflected in the aims of physical education as stated by Alberta Education (1983). These aims are to provide children with the opportunity for developing motor skills, physical fitness, emotional control, socially acceptable behaviour, and to provide desirable attitudes toward leisure activities.

The goals of the physical education curriculum as outlined by Alberta Education (1983) state that "each child should proceed at his or her own rate" (p.1) in exploring and developing skill in movement, and that the "schools should provide situations in which achievement, satisfaction, and enjoyment" (p. 2) can be attained. However, no clear provision is made in the curriculum for the variable motor development rates observed in children. There appears to be no special training (pre-service or in-service) nor support systems within the public jurisdiction to provide teachers with the means for delivering a physical education program accounting for the divergent motor performance levels observed in school-aged children. Teachers are trained to recognize and to devise programs suited to individual needs in reading and mathematics, but there seems to be a need for devising similar programs for children who are slow to develop gross motor skills. Furthermore, research indicates that the reluctance teachers feel about identifying and labelling children with motor difficulties is often expressed in questions about follow-up remediation (Appendix E). Hence, there is a catch 22 situation in which programs are needed for physically awkward children in order to encourage teachers to identify children with motor difficulties. In the ideal situation the identification process should be part of a broader program development and implementation project to help children with movement difficulties.

Besides providing an environment for learning, one of the prime responsibilities teachers have is to assess the progress made by their students and at regularly scheduled intervals during the school year they do so. Therefore, assessment is a very familiar task for elementary school teachers and they should be able to assess the physical performance of their students in order to identify those with inefficient movement. There are some reservations connected with this premise which will be discussed in the next section.

Teacher Attitude Toward Change

It is not unusual for teachers to initially present barriers to innovation (Sarason, 1982; McLaughlin & Marsh, 1978; Fullan, 1984) especially when an outside agency is initiating the new program. Teachers can therefore be expected to view a process for the identification of physically awkward children with scepticism. In the past they have seemed cautious, and rightly so, about identifying children for any reason. It is suggested however, that if a sense of ownership can be established for a project, then teachers are usually enthusiastic about reaching its goals (McLaughlin & Marsh, 1978).

Open discussion with the teachers combined with a consideration of teachers' suggestions should promote the acceptance of proposed new programs. If teachers perceive that their input is accepted and acted upon they will become convinced of the value of a program (Sarason, 1982; Fullan, 1984). Moreover, since innovations that increase the teachers' feelings of efficacy have an intuitive appeal (McLaughlin & Marsh, 1978), it is essential that teachers perceive a process for the identification of physically awkward children as a means to improve the services they deliver to their students.

Personal contact is the major vehicle for establishing positive relationships with staff members in a school during any educational change process (Leithwood, 1981). Henderson and Hall (1982) used this approach successfully to help identify physically awkward children within one school in the United Kingdom.

The overt support of the principal is also important as it lends authority to the implementation of projects requiring a change in focus (Berman & McLaughlin, 1976) such as this screening procedure to identify physically awkward children. Clearly, the first contact with teachers must be carefully planned and sensitively carried out if the full cooperation of the professionals involved is to be obtained.

Teachers as Observers

Keogh (1977) suggests that teachers are in the best position to observe children and to accumulate information about them. Stott (1978) concurred with this opinion but noted that teachers were inclined to resort to statements of the problem rather than to report actual behavicurs. He found however, that teachers were excellent observers after being trained to study the child from the point of veiw of remediation rather than that of defining problems (Stott, 1978). In other words, when teachers could think in positive terms about the correction of children's behaviour, they made clear and precise identification of behaviours. It follows then, that the success of an identification process such as this, rests to some extent on the training skills of the researchers and their ability to communicate the nature of the problem, the syndrome of behaviours associated with it, and the major steps that must be taken to ameliorate the problem.

A number of past studies suggest that it is important to deliver detailed explanations on more than one occasion and to provide the teachers with the ongoing support and information they need (Knowles, 1981; Henderson & Hall, 1982). Continued contact appears to establish a positive climate that promotes mutual confidence when collecting information from teachers about their students (Fullan, 1984).

Teacher Training

According to a cross-Canada survey of 1107 physical educators from Kindergarten through grade 12 (Watkinson & Bentz, 1985), 53 per cent of the teachers had only one or two courses in physical education and in fact, 19 per cent had no professional training in physical education whatsoever. Therefore, it is reasonable to assume that the teachers in this study will not have extensive training in physical education. It was reported by the teachers of physical education who took part in the present study that none had taken more than one summer course in physical education. Although it is expected that teachers will possess the previously mentioned talent for observation gained through daily interaction with children (Elbaz,1983), this ability may not include the assessment of physical skills due to a lack of specific training in the analysis and assessment of motor skills within the physical education setting. Thus an orientation and training period is necessary before teachers should be asked to focus their observational skills on the motor development of their students. While teacher training is essential to obtain valid data, the use of rating scales is an efficient method for teachers to record observations. Rating scales are familiar instruments to teachers and can be used to gather information about the movement patterns of their students.

The Use of Rating Scales For Identification

Finding a workable screening procedure for physically awkward children is not easy. The physically awkward child within the normal population seems to be elusive and difficult to identify. Scales used in the past have not established a consistent method of isolating children who are experiencing motor difficulties (Gubbay, 1975; Keogh et al., 1979). In addition, Keogh (1977) notes that motor screening tests are usually lengthy and are seldom culturally valid. Another drawback about existing motor screening tests is that most current instruments, such as A Test of Motor Impairment (Stott, Moyes & Henderson, 1972), require specialized training not usually acquired by the teacher of physical education in elementary schools. In the view of Taylor and Clifford (1985), a significant problem with many existing motor tests is that they identify deficits (Gubbay, 1975; Stott et al., 1972) which describe the problem instead of pinpointing an entry level for remediation. This aspect of identification pointed out by Taylor and Clifford (1985) demands serious consideration so that remediation can begin early in the child's school career.

The use of checklists and behavioural rating scales by teachers has been established in educational systems as a method of identifying children with learning problems. Rating scales offer detailed qualitative information about subjects observed over a long period of time which in turn supplements quantitative measures. The advantages of rating scales are many; they are easy to use, they can be used unobtrusively, and they can be administered with little or no training (Irwin & Bushnell, 1980). Good rating scales are economic of both time and money. The items on a rating scale can cover a longer period of observation than a single testing session and the information that they supply is very useful in building a profile of behaviours. For these reasons rating scales and checklists have been employed to discriminate children with learning problems. However, there has been some difficulty with scales used in the past. Those intended to isolate children with learning disabilities in the motor domain were often confounded with social behaviours.

Inappropriate social behaviour can be indicative of incompetence in some domain of achievement and poor physical performance often leads to a negative self-image resulting in behavioural problems in activity situations. For this reason social behaviours that are unrelated to sport and play activities were included in early rating scales or checklists attempting to identify physically awkward children (Sugden, 1972; Gubbay, 1975). It is true that some of the targetted behaviours are recognizable as concomitant with a syndrome of awkwardness (Wall & Taylor, 1984) however, the prime target is the inability to perform competently in normally expected physical skills.

In 1972 Sugden designed checklists for teachers to use in identifying physically awkward children in kindergarten classes. His checklists included items concerning handwriting, classroom behaviour, playground activities, as well as items about physical skills. In follow-up studies Reynard (1975) and Calkins (1977) found there was minimal agreement between the motor task assessment, the researchers' observations and the teacher identification, while using these checklists.

Gubbay (1975) used a 7-item behavioural checklist for teachers that seemed to screen students and identify physically awkward children fairly well. Taylor (1982) however, notes the vagueness of the items in Gubbay's checklist and questions the cultural validity of the results. One item assesses a soccer-like dribbling skill but the test is performed using a tennis ball under the sole of the foot. Gubbay validated this task on a very large sample of Australian school children but this task does not seem related to a culturally normative motor skill. The teachers check lists contained questions in Gubbay's study such as, " Does this child fidget excessively in class?" , and "Is the child's conduct much below average?" , which are vague questions and they are not specific references to skilled motor behaviour.

Another method of having teachers rate the motor performance of their students was designed by Henderson and Hall (1982) who asked only one question of teachers in order to screen out physically awkward children. Teachers were requested to identify those children, "who had poor motor coordination for their age and whose lack of coordination was significantly affecting their school work" (p.449). In this instance the researchers developed a rapport with the teachers in one school over the course of a year so that the teachers met frequently with Henderson and Hall to discuss the issues of physical awkwardness and thus the one question used for identification would likely be thoroughly understood from the perspective of the researchers.

If there is no opportunity for this long-term rapport with teachers to be developed then rating scales should include more items about specific behaviours. Keogh, et al. (1979), pointed out the problem of internal validity in rating scales that contain items unrelated to play and sport activities. One should be mindful of this warning in constructing rating scales to be used by teachers who are more at arm's length than the teachers in Henderson and Hall's (1982) study. To deal with this particular problem Umansky (1983) developed a rating scale that included items dealing only with school-related physical activities. Umansky (1983) concluded that teachers were able to identify physically awkward children using her Teacher Rating Scale.

The Umansky Scale was revised by Clifford (1985) and again for a pilot project within the Edmonton school system in 1985/86 (see Appendix E). The items were rearranged in progressive learning order but there were still problems in administration. These are discussed in the Pilot Project (Appendix E) and also in the Methods section of this document (p. 62) which explains the development of a further refinement in an attempt to render it more valid and reliable an instrument for teachers to use in the screening and identification of physically awkward children.

One very important aspect of rating scales not considered before is that they enable the observer to take into account the movement confidence of a child (Griffin & Keogh, 1982). This kind of observation can only take place in a social milieu. Thus, while motor tests are invaluable to assess discrete skills and capabilities, the child's application of those skills with control and competence in a game situation can only be observed in a group setting, preferably in a normal atmosphere of sport or play. This facet has been incorporated into the rating scales devised for this study by relating the items to movement confidence as well as competence and by asking for teachers' observations during physical education classes.

Based on Wall's (1985) premise of the progressive nature of skill development from simple through reactive to complex skills, two rating scales were designed for this study; The Motor Performance Rating Scale (MPRS, Appendix A) and a longer more detailed Motor Development Rating Scale (MDRS, Appendix B). The MDRS includes more detailed items arranged in a progressive order from simple to complex physical skills. It has two parts; one for teachers to rate students in the primary grades, and one part to be used for rating students in grades four to six. The Methods section of this document describes the development of these rating scales.

Motor Performance Tests

Procedures for assessing the motor performance of children have changed over the years depending on the objectives of the assessors. One of the first to tabulate motor performance in children was Ozeretsky. He designed a test in 1923 to assist in the clinical diagnosis of neurological and motor deficiencies in children (cited in Morris & Whiting, 1971) and later in 1955 the Lincoln-Ozeretsky test was published paring down the original 85 items to a more manageable 36. During this time there were many adaptations to the Ozeretsky test designed to "calculate the motor age of a child and to draw conclusions on the basis of comparison with the performance of normal children" (Morris & Whiting, 1971).

Then in 1972 the Stott, Moyes and Henderson Test of Motor Impairment was designed for regular school children with the intent of screening out those children with inefficient motor performance. Stott and his colleagues (1972) were not interested in a medical diagnosis or in establishing a motor IQ. They used items selected from the Lincoln-Ozeretsky test to find those children who would benefit from remediation in the motor domain. In addition to evaluating gross motor efficiency and general coordination, the Stott, Moyes and Henderson Test of Motor Impairment (1972) was used to identify manual dexterity.

Gubbay (1975) had similar goals when he designed a battery of tests specifically to discriminate awkward from non-awkward children and he focused on both fine and gross motor coordination. He developed 17 tasks for this purpose and after conducting a pilot study, chose the eight most reliable items to assess 992 children within the normal school population (Gubbay, 1975). Younger subjects (below the age of 8 years) were eliminated after preliminary studies because it was felt that the screening tests were not "sufficiently critical in this age group" (p.109). Gubbay (1975) emphasized at the time that no single measure could identify all the children in the potential pool of awkward children.

Many researchers have attested to the limitations of screening tests for the identification of physically awkward children. As mentioned above, Gubbay (1975) suggested that one measure was inadequate to identify all awkward children. The same feelings were expressed by Keogh, Sugden, Reynard, and Calkins (1979) who made a plea for a multi-assessment procedure. Taylor (1982) developed a motor assessment procedure in accordance with these notions using some of the items from both Stott et al. (1972) and from Gubbay (1975) to identify physically awkward children. Her test battery can be used to assess developmental levels of performance because items were devised to consist of tasks for ages five and six (Taylor, Smith, Squair & Wall, 1984), as well as for age seven (Taylor & Clifford, 1985), and for ages eight to twelve (Taylor, 1982; Stott et al., 1972). Taylor's multi-dimensional approach to assessment procedures was subsequently used as a basis for prescription and remediation in the Motor Development Clinic at the University of Alberta. In her work with physically awkward children Taylor's assessment procedures evolved to include six different components. These components include the observation of free play, a motor performance test battery, selected items from Canada Fitness Awards (1984), an observation of selected motor patterns (McClenaghan & Gallahue, 1982), an evaluation of the knowledge of body parts (Sherrill, 1981), and an action word checklist, supplemented by a parental and teacher interview (Taylor & Clifford, 1985). Information about the performance of a child in the continuum of skills as derived from a multi-assessment can present a clear indication of the level at which to begin remediation. It is easy to see that one set of scores does not provide the necessary data to determine intervention levels for follow-up procedures once identification has occurred.

In the current study a composite battery of motor tests named the Gross Motor Competence Test (GMC Test) was used to validate the information about children's motor performance gathered through teacher observation from the rating scales. Seven of the gross motor tasks on the GMC Test were selected from the Stott, Moyes and Henderson Test of Motor Impairment (1972), one was adopted from Gubbay (1975), and four Canada Fitness Awards tests (1984) were used.

CHAPTER III

METHODS

Sample

Six Edmonton Public schools agreed to participate in the study to determine if regular elementary school teachers could use a screening procedure to identify physically awkward children within their physical education classes. The schools were located in different areas of the city; two were large suburban schools, one was a small school in the University district, one had a high population of special classes for children with learning disabilities, another was a special school with a German language immersion program, and one was classified as an "inner city" school.

Spring was chosen as a good time of year for teachers to screen children for gross motor competence because at this time they would have had eight months in which to observe their pupils in physical education classes and on the playground. In April, 1986, the six schools involved in the study were visited by the researcher in order to introduce the study, explain its purpose, and to gain the confidence of the staff in each school. At this time a package of information including illustrations of initial, elementary, and mature forms of running, throwing, catching, and jumping, derived from McClenaghan and Gallahue (1978) and from Wickstrom (1977), was distributed to all the teachers in each school (Appendix D). Discussions were conducted with the teachers about the expected levels of performance in physical skills for different ages of children. The characteristics of physical awkwardness were outlined to emphasize the extent and seriousness of the problem and the researcher conveyed the necessity of identifying children with movement difficulties in order for them to benefit from any available remedial help.

The principals of each school wanted concensus from their teachers before allowing their students to take part in a screening and assessment project. Five of the school administrators decided to have teachers screen all of their pupils while one decided to screen only primary grades. The same reaction emerged from the pilot project (Appendix E, 1986) when one in four schools screened only the students in Kindergarten to grade three.

Procedure

Screening

This research project was based on a two-staged identification process. Two rating scales were developed for this purpose; one for quick identification which was used in the first phase of the screening procedure and one to produce more detail about the students' motor performance levels.

Stage one in the screening procedure took the form of introductory meetings in each of the six schools involved in the project. At these initial meetings typical behaviours manifested in a syndrome of awkwardness were outlined and the purpose in identifying children explained. Orientation followed the introductory meetings with each staff and at this second meeting the Motor Performance Rating Scale (MPRS, see Appendix A) was distributed to the teachers who taught physical education. Time was taken to explain the items on the scale while reiterating the characteristics of the physically awkward child.

Thirty-eight teachers, none of whom were specialists in physical education, were involved in the identification process. Only 8 of the teachers involved in the study had taken at least one summer course in physical education. Five of the teachers were male and 33 were female. Six teachers had 20 or more years experience, 18 had been teaching from 6 to 15 years, 13 had 5 or fewer years experience and 1 was an apprentice teacher. This distribution was thought to be representative of most elementary school systems.

Following the initial contacts with the schools, approximately 1000 children were screened by the teachers, On the basis of the initial statement on the MPRS, "I am concerned for the motor development of this Student. YES or NO" (Appendix A) 105 children were identified by their teachers as being possibly physically awkward. This number represents 10.5% of the total population.

Before the rating scale was completed by the teachers a control group of students was chosen. For each identified subject, a student of the same sex was selected from the same class whose name appeared next on the class list and whose age-in-months was within three months of the experimental subject. In the Edmonton Public School system there is rarely more than six months difference in the ages of students in the same grade. The range in ages was from one to three months difference between the control and the experimental subjects in this study.

Parents of both the experimental and control subjects were asked to submit written permission for their children to take part in the study and to be assessed by a group of volunteer researchers using the Gross Motor Competence Test battery. The Permission form can be seen in Appendix D and the Gross Motor Competence Test battery is presented in Appendix C.

At this time instructions for completing the rating scales were outlined to the teachers of physical education in each school. Objectivity in rating the motor behaviour of children is important in order to offset any leniency or bias teachers may have for certain of their students and this was discussed with the teachers involved. It was suggested that rating one item at a time for every students would help to prevent the tendency to give the same rating to items in proximity (Irwin & Bushnell, 1980). The teachers were reminded that the rating scales were intended to rate gross motor activity exclusively. This focused approach was intended to prevent a halo effect in which other behaviours of school children might influence the judgment of their gross motor performance.

The teachers then completed the ten items on the Motor Performance Rating Scale (MPRS) for each child believed to be physically awkward and for each child in the control group. The ten items required the teachers to rate the skillfulness of the children in their classes by comparing them to their classmates when they run, balance, catch or throw a ball and climb on playground equipment. Teachers were asked to note the frequency with which their students took part in physical activities with their peers, played ball games and sought opportunities to be active. The scale also asked teachers to decide whether each child seemed fit and how quickly he or she learned physical skills (see Appendix A).

One week later in stage two, detailed explanations of the longer twenty-four item Motor Development Rating Scale (MDRS, see Appendix B) were made to the same teachers. The teachers were then asked to complete this more detailed rating scale for each child in the experimental group and for each child in the matched sample. Teachers were allowed two weeks in which to complete the MDRS. This scale required them to assess a given child's motor performance on skills like gymnastics or games and on general control while moving. The teachers were to rate the subjects motor performance levels in relation to the performance of their peers. Three levels of skill were targetted by the MDRS. First, simple skills like running, jumping and hitting a stationary object, were used extensively on the 1-3 rating scale (see Appendix B). Secondly, items concerning reactive skills that require a higher degree of involvement by the participant were placed at the end of the scale for younger children but were interspersed throughout the scale used for children in grades 4-6. Thirdly, items concerning complex skills, those skills that rely on cognitive input for solutions to motor problems, were at the end of the scale for older children. Procedural and declarative knowledge about action that these items illustrate would be seen overtly in the level of skill development observed by the teachers. The longer rating scale required teachers to assess a given child's motor performance in relation to the performance of his or her peers while performing the specific skills listed on the rating scale. Only the teachers who teach physical education rated the students because the items are designed to be representative of gross motor activities that are usually observed in the gymnasium and are outlined in the physicial education curriculum. These data were compared with the results of the subjects' scores on the motor performance tests which were completed in the next step in the identification procedure.

It was expected that children in the control group would probably be non-awkward (NA). Of the 105 children identified as physically awkward (PA), permission to conduct motor assessment was granted by the parents of 76. Seventy-three of their grade-matched peers (NA) were allowed by their parents to participate in the study. Subsequently, 146 children completed physical fitness and motor performance tests in order to assess the validity of the initial screening process. Finally, only the results from 116 subjects were used in the statistical analysis. The data concerning certain children were not used in the analysis for the present study, for instance, children below the age of 84 months were not included because the motor tests for seven year olds substantially differed from the rest of the group. In addition, children with recognized learning disabilities who might have neuromuscular problems as outlined in the delimitations, were not included in the analysis. The number of subjects was also limited due to unmatched pairs of experimental and control subjects who lacked parental consent.

Motor Assessment

Assessment was the process in which standardized tests were used to measure the performance levels of the children included in the study in order to determine if the group of children judged to be physically awkward by their teachers performed gross motor skills less well than the control group. If remedial help were available the assessment could be used to draw up a profile of each child's motor performance illustrating the strengths and weaknesses of each child in relation to his or her peers.

A team of researchers was trained to administer motor performance tests to the sample of potentially awkward children and to the matched control subjects (see Manual for Researchers, Appendix D). All of these researchers had been instructors at the Motor Development Clinic at the University of Alberta for one or more years so that they were experienced in testing, prescribing and designing remedial programs for children with motor performance difficulties. Training sessions for the research team included test-specific demonstrations and practice in order to insure a consistent procedure for gatherering data. A norm-referenced manual was adapted from the model used in, "Assessment and Prescription for the Physically Awkward" (Taylor & Clifford, 1985). Taylor and Clifford (1985) recommend the following methods for the sensitive and efficient assessment of motor skills in children:

1. Try to develop a rapport with the child before testing ensues, e.g., talk, joke, dicuss likes/dislikes, etc.
2. Encourage the child to perform as well as he/she can, for example praise good efforts. Explain to the child that some tasks may be difficult. That is the way the test is designed.
3. Be supportive. Reassure the child after each attempt to perform a given task.
4. Encourage the child to relax enough so that he/she can give his/her best effort.
5. Discontinue testing when failure is evident. Do not end the test on a negative note but attempt to teach the child to perform the test.
6. Let the child know that you appreciate his/her efforts.

The researching team visited each school and administered the selected motor tests to all 146 children individually in their home gymnasiums. The team was not informed about which subjects had been identified as physically awkward (PA) and which were acting as controls (NA).

Following is a description of the motor performance tests and the rationale used in selecting the items for this study.

Motor Tests

The value of developing rating scales and screening procedures is very clear. This study is part of an overall attempt by researchers in motor development and adapted physical education at the University of Alberta to develop instruments to assist in the identification of physically awkward children. In so doing it must be recognized that the state of the art in this area is still in the exploratory and development phase hence choices were made to use gross motor test items that were deemed the best available at the time to assess the motor performance of children.

The Gross Motor Competence Test (Appendix C) was developed in consultation with experts in the field and it included items concerning gross motor skills only. It is recognized that further research and revision of this battery is needed. However, the major thrust of this study was the development of rating scales that might help in the identification of physically awkward children. Considerable development work went into the construction and revision of the two rating scales in the belief that their use would enhance future studies of the value and validity of related motor performance test batteries in the screening and assessment of physically awkward children. Research in this area can therefore be viewed as a bootstrapping operation where progress in one area might require accepting the state of development in another area.

The Gross Motor Competence Test battery (Appendix C) used in the assessment procedures included items selected from three valid and reliable motor test batteries. The items used were; the controlled jump, the wide board balance, a stork balance, and a wall throw (adapted from the Stott, Moyes and Henderson Test of Motor Impairment 1972), the clap and catch test (adapted from

Gubbay,1975) and four items from the Canada Fitness Awards (1984) program as follows. Since a syndrome of awkwardness implies a withdrawal from and a lack of practise in physical activity, an accompanying decline in the level of fitness can be expected in physically awkward children (Wall & Taylor, 1984; Paton, 1986). It was thought that low fitness scores might therefore, be one means of discriminating physically awkward children from their more motorically adept peers. It should be noted that since the Canada Fitness Awards (1984) are often included in the physical education programs in many schools fitness activities can be veiwed as culturally-normative activities for elementary school-aged children.

The fitness items chosen for this study were; the standing long jump, the shuttle run, curl-ups, and push-ups. All four of these items were included in a pilot project (Appendix E) and found to be good discriminators of physically awkward children. Paton (1986) found that very few physically awkward children were able to perform pushups and curlups proficiently although the norms were established on a large sample of Canadian children. The standing long jump was selected because it is a good measure of gross motor coordination as well as leg power (Rarick, 1975). Many awkward children score very low on this item (Taylor, 1982; Paton, 1986). A fourth Canada Fitness test, the shuttle run, was included in order allow the testers to observe the level of skill development seen in this task in addition to assessing the running agility of the subjects in accordance with the Canada Fitness norms (1984). There is a certain ease of administration in using Canada Fitness Awards tests

(1984) because reliable national norms are established. It is also possible for these tests to be used by relatively untrained teachers in future assessment procedures.

Keogh et al. (1979) recommend that motor screening procedures meet local needs and since the test items adapted from Stott, Moyes and Henderson (1972) and Gubbay (1975) have norms established specifically for Edmonton school children (Taylor, 1982; Taylor, Smith, Wall & Squair, 1984; Taylor,1985; Taylor & Clifford, 1985) they should be ecologically valid. Two of these items effectively measure balance and lower limb coordination; motor competencies that are basic to culturally normative activities like climbing, running, jumping, skipping. The ball skill tasks assess skills that have a high value within the cultural milieu of elementary school children both for boys who are culturally drawn to games of baseball or football and for girls who enjoy handball, wall games, or "two-ball". Motor tasks that reflect progressive skill development were chosen for the younger subjects such as the high jump instead of the controlled jump, hopping on one foot rather than the wide board balance, and ball bouncing instead of the wall throw (Stott, Moyes & Henderson, 1972). These tasks are used to measure balance, controlled power jumping and ball skills.

There was a total of 12 tasks for each age group assessed in the study using the Gross Motor Competence Test battery (Appendix C). Step-by-step descriptions of these motor tests are given in Appendix C.

Evaluation

Evaluation was the third part of the procedure. The motor performance of the children who were assessed was evaluated according to the norm-references available for both Canada Fitness Awards (1984) and the Gross Motor Competence Test battery (Taylor,1982; Taylor, Smith, Squair & Wall, 1984; Taylor, 1985). All scores were recorded in percentiles but it was deciced to use a composite stanine score derived from the raw scores to determine which subjects could be classified as physically awkward. Children were classified as physically awkward if they obtained a mean standard score below the fourth stanine (stanine 3.99 or less) on the twelve motor and fitness tests for grades 1-3 and below stanine 4.49 for grades 4-6. This method of classification was chosen based on previous studies. The classification of physical awkwardness was decided by counting a predetermined number of low scores achieved by individuals on motor test batteries such as 4 or 6 scores below the tenth percentile (Stott, Moyes & Henderson, 1972; Gubbay, 1975; Taylor, 1982; Pilot Project, 1986). Sometimes additional professional judgment was required to designate a subject as awkward or non-awkward based on the profile of scores on all sub-tests as was done in the 1986 Pilot Project (See Appendix E). The use of a mean stanine score accounts for overall low scores and this it compares the scores of the experimental subjects with their peers, the controls. A composite score in the third stanine would be one standard deviation below the mean of the group and a score of 4.49 would be one half a standard deviation below the mean.

Details of the rating scale development for this study will be presented in the next section.

Development of the Rating Scales

Procedure

Theoretical base

The theoretical basis that was chosen in the construction of the rating scales in the current study was the notion that knowledge about action is acquired through experience and practice (Wall, et al., 1985). Since the knowledge about action one would expect to find amongst school children would reflect their cultural environment, rating scales must include items that are culturally normative motor activities. To help determine the culturally normal motor skills to include in rating scales Lindsay (1984) was consulted regarding the playground games in which children participate. In addition, practising teachers volunteered information about the physical play activities of school children. The Alberta Curriculum Guide (1983) was used to ascertain what physical activities might be normally offered in school programs.

Rating scales have to account for the theoretical base outlined and yet should be rational to teachers if they are to be asked for input during the screening procedure (Fullan, 1984). Draft copies of the rating scales were circulated among elementary teachers in schools not involved in the study and to teachers in the Faculty of Education at the University of Alberta. The advice of these professionals was accepted regarding the clarity of the wording and the terminology used. Mutual understanding between researchers and teachers is necessary to establish the content validity of the rating scales.

The rating scales devised for this study were aimed at physical activities offered in school programs to help the teachers focus on specific performance inadequacies in motor skills that are familiar to them. Common overt behaviours that teachers are apt to observe were emphasized and the items were arranged in an order that accounts for the developmental learning of school children. These rating scales asked teachers to rate a given child's motor performance in relation to his or her age-group peers.

The idea that motor confidence is as important as motor competence (Griffin & Keogh, 1982) was also used as a theoretical guide in devising items for the rating scales. Activities that contain perceived physical risk or activities requiring fearlessness like climbing, jumping, swinging, and so forth, were included to obtain information about movement confidence. Some items asked the teachers to record their observations about their pupils' enjoyment of physical education classes. It was felt that teachers could judge both competence and confidence in the performance of their students if the items on a rating scale were directed at activities requiring one or the other factor and that this would give evidence of accumulated information in the area of affective knowledge in addition to procedural and declarative knowledge about motor activity. Teachers are actually in a position to observe the movement patterns of their students in group or team situations and therefore may be able to judge both the social confidence and the physical competence displayed by them. It is recognized that a child might perform more successfully in a familiar physical education activity than in a discrete motor testing situation in which the researchers (strangers to the subjects) will be involved. The teacher is in a position to evaluate the ongoing everyday performance of the child.

Furthermore, the items were arranged from simple to complex skill (Wall, 1985; Smith, 1988) allowing for progressive skill development as children are promoted to more senior grades. The scales were developed over a period of time through application in a pilot project (see Appendix E) and subsequent consultation with practising professionals.

Motor Performance Rating Scale

A Motor Performance Rating Scale was used by teachers in four elementary schools in a Pilot Project (see Appendix E) to identify physically awkward children. It was intended to be used as a screening device that would enable teachers to quickly determine whether or not their pupils had motor development problems. This initial scale included ten items concerning easily observable overt behaviours that a teacher might see in the gymnasium or on the playground such as running, catching, balancing, or playing games. The key statement on the scale was, "I am concerned about the motor development of this child." The fact that a rating scale was completed for a particular child was in itself a screening process.

The rating scale asked the teachers to rate the children about whose motor development they were concerned on a continuum extending over four points. Two of the points on the continuum were on the awkward end and the other two were on the skillful end of the continuum.

The Motor Performance Rating Scale developed for this study was a revision of the one used in the 1986 pilot study (See Introduction in Appendix E) and some of the items were changed. For example, items about fine motor performance were dropped since physical awkwardness in this study was delimited to gross motor behaviour. One item used in the pilot study asked the teachers to rate the frequency with which children avoided physical education and very few subjects were rated low on this item. It was therefore recommended that this item be dropped from future scales (see Results in Appendix E) but it was decided, for the present study, to re-test the notion that children will avoid physical activity if they have accumulated negative affective knowledge about action. A section in the longer MDRS was composed of items asking about feelings and attitudes concerning physical education. In the final revision of the scale for this study the awkward categories were all listed on the same side of the form as suggested by Cronbach (1960) in contrast to the multi-directional format used in the pilot study. The Conclusions in the pilot study recommended this change (see Appendix E). This short ten-item scale targets general impressions of gross motor activities and the raters have only to give information on perceptions that have been collected over their long association with specific pupils. The revised Motor Performance Rating Scale used in this study can be seen in Appendix A.

Motor Development Rating Scale

Umansky's (1983) teacher rating scale was one of the first to focus on culturally-normative motor tasks. Following the lead of Umansky and the recommendations of the pilot project (Appendix E), a rating scale composed of culturally-normative activities was drafted using the Alberta Education Curriculum Guide (1983) as a resource for the activities that Edmonton school children would be exposed to in their physical education classes. The teachers seemed to relate well to rating categories that asked for frequency of observation used by Umansky (1983) rather than the response continuum used in the pilot study (Appendix E) therefore, rating categories based on frequency of observation were used in the draft copy of the scale for this study. It was then reviewed by a number of practising professionals.

A draft copy of the Motor Development Rating Scale was distributed to 15 physical education professionals at the University of Alberta and in the Edmonton Public School Board asking advice as to the appropriateness of the items selected for the new scale. Although there was general support and approval for the intent of the study, many of the criticisms indicated the difficulty teachers might encounter when rating such very specific items especially with the teachers' perceived maturational difference between children in kindergarten and grade four. It was also pointed out by the experts, that while most physical education programs would be similar, many of the detailed items such as stick-handling in floor hockey, or the avoidance of handstands, were very selective activities not necessarily observed in physical education classes. It was therefore decided with further help from the experts that the current study would incorporate a list of generic skills and behaviours such as the competence observed in students when handling small apparatus, or while playing group games.

A format that resembles Harter's Perceived Competence Scale (1982) was adopted. Each item in this format gives descriptions of two opposing types of behaviour and the rater must first place the child's behaviour on one end of the continuum or the other and then rate the frequency of the observation (see Appendix B). In this way a four point rating scale can be utilized. A space is still provided for "no opportunity to observe" as advised by Cronbach (1960) and Guildford (1967). Simpson (1953) was consulted concerning the stability of meanings for rating terms to decide on the wording used for the categories of frequency that might be most condusive to precise judgments for teachers to make. On this basis, the categories of "sometimes" , and "almost always" were selected. Irwin and Bushnell (1980) suggest that scales should list target behaviours in a logical order from least difficult to most difficult and that similar items should be listed together, therefore, the items on the Motor Development Rating Scale are listed in progressive order from simple through reactive to complex skills. Further, on the suggestion of the experts, two versions of this scale were developed; one for grade one to three (1-3), using mostly items asking about simple skills, and another listing more reactive and complex skills for grades four to six (4-6). The items on both versions were divided into four sections containing activities related to the physical education curriculum outlined by the Alberta Department of Education, for example; "General Movement", "Gymnastics", and "Games". A fourth section, "General Impressions", deals with the observation of children's feelings about physical activity.

In order to have teachers accept completing the scale more readily than was witnessed in the pilot study (Appendix E) fewer items were included than in the 40-item Umansky-Clifford Teacher Rating Scales (1985). As recommended after the pilot project (Appendix E) the rating scale was reduced to a more manageable 24 items on each of the 1-3 and the grades 4-6 versions (see Appendix B).

After compiling information received from the experts in the field and revising the rating scales in accordance with the findings, the items were surveyed to ensure that they fit Wall's (1982) definition of culturally-normative activities. Three different experts were consulted about this final draft to insure that the content of the rating scale covered the subject matter and the probable course content in physical education programs. The general motor patterns selected like running, throwing, and catching, and so forth, can be seen as culturally-normal play activities of young children. Some of the items emphasize the motor confidence that

Griffin and Keogh (1982) define in their article and that teachers are able to observe on an everyday basis.

CHAPTER IV
RESULTS AND DISCUSSION

Introduction

A total of 105 children in six different public elementary schools in Edmonton were identified by their teachers as being physically awkward. The main question in the current study was to determine if teachers of regular classes could identify physically awkward children within their physical education classes. Eight of the 38 teachers in this study had taken one summer course in physical education and none were specialists. Those teachers who were responsible for teaching the physical education classes rated the students' gross motor performance. Some teachers taught physical education to their own class and in addition they taught a colleague's class, thus 4 of the teachers were responsible for identifying as many as 4 to 6 physically awkward students out of 2 classes. Thirty-one of the teachers screened their own classes and identified 2 or 3 physically awkward pupils in each class. One teacher of grade six identified only one student as having difficulties with the performance of gross motor skills and 2 teachers judged that none of their students were physically awkward. In addition to teaching physical education classes most teachers were on a duty roster to supervise school playgrounds at recess or lunch time and therefore would have had opportunity to observe the playground activities of their students. April and May were chosen as a good time to have teachers rate the gross motor performance of their students because they would have observed the developmental level of their students' skills over a period of 8 or 9 months and over 3 seasons of the year.

As mentioned in the delimitations (see p. 14), data concerning children below the age of 7 years (84 months) and students with special needs were not included in the analysis of results. School children aged more than 7 are normally in grade one or above. Children who had been assessed for special education placement were not accepted for the study because some would have known neurological conditions while others might have suspected neurological problems. Another limitation on the number of subjects in the study resulted from a lack of parental permission. If the experimental or paired control subject did not have parental permission to take part in the motor assessment procedures then both subjects were dropped from the study. Parental consent was granted for 58 experimental and 58 matched control children to be assessed. The same teachers who rated the experimental subjects also rated the control subjects who were in their classes.

It was expected that half of the children identified would be girls and the other half boys as reported by previous researchers (Taylor, 1982; Gubbay, 1975; Pilot Study, Appendix E). In the current study however, 34 teacher-identified experimental children (PA) were boys and 24 were girls (Table 1). There were 15 girls and 16 boys in the older age group (grades 4-6) but there were twice as many boys as girls in the younger group (grades 1-3, see Table 1).

Table 1. Numbers of teacher-identified physically awkward children and numbers of controls in each grade.

Grade:	one	two	three	four	five	six	Total
PA boys	6	6	6	9	6	1	34
PA girls	4	3	2	9	6	0	24
total	10	9	8	19	12	1	58
NA boys	6	6	6	9	6	1	34
NA girls	4	3	2	9	6	0	24
total	10	9	8	19	12	1	58

A total of 116 children were assessed and evaluated in the present study. The "Yes" answer teachers gave, indicating their concern for the motor development of their students, constituted the initial screening. If a student was thus identified by his or her teacher, then that subject was placed in the category PA (physically awkward) for further analysis. The control group was designated as non-awkward or NA.

The results will be reported in three phases and account for the four methods of identifying PA children; the teachers' concern or "Yes" answer, the Motor Performance Rating Scale (MPRS), the Motor

Development Rating Scale (MDRS), and the Gross Motor Competence Test battery. Phase one of the results will answer the questions; Do the physically awkward children (PA) identified by classroom teachers differ from the control group (NA) in the performance of gross motor skills?, and Do the teachers rate the PA and NA subjects differently using the ratings scales devised for this study? The scores of the two groups of subjects will be compared on each of the following instruments:

1. Gross Motor Competence Test (Appendix C)
2. The MPRS, a ten-item rating scale (Appendix A)
3. The MDRS, a 24-item rating scale (Appendix B)

The difference in the motor performances of identified boys and girls will be presented in phase one. Phase two of the results will examine the reliability of the rating scales. The accuracy rate of the teachers' observations as assessed by the Gross Motor Competence Test (Appendix C) will be examined in phase three. In this section cut-off scores will be established for the motor tests and the rating scales using the cumulative frequency of the scores reported in phase one. A decision as to whether subjects are truly physically awkward or non-awkward will be made by using these cut-off scores. Validity of the rating scales will be addressed in reference to the cut-off procedures and the motor tests by assessing teacher accuracy. Content validity was assessed by referring to practising physical educators.

PHASE 1: Scores on the Motor Test Battery

Gross Motor Competence Test

The main question in this research project was to find if regular elementary teachers could identify physically awkward children in their physical education classes in accordance with the best currently available motor tests. The Gross Motor Competence Test battery (Appendix C) used in the study was a composite of twelve motor performance and fitness tasks whose validity and reliability had been established to some extent at the time. The motor tests included eight tasks designed to identify children with inefficient motor performance; one adapted from Gubbay (1975) and seven from the Stott, Moyes and Henderson Test of Motor Impairment (1972). The scores were recorded both as raw scores and as percentiles using the norms established amongst Edmonton school children (Taylor, 1982; Taylor & Clifford, 1985; Taylor, Smith, Squair and Wall, 1984). Four Canada Fitness Awards tasks were also used as items on the Gross Motor Competence Test (Appendix C). The norms on the fitness tasks were validated across Canada in 1984 revising the norms and percentile rankings established in 1967. The differences in percentile rankings of the experimental (PA) and control subjects (NA) are illustrated in Figures 2 and 3.

Motor Performance

While the percentile scores recorded in the procedures allow for a clear comparison of the relative performance of subjects on different variables, they do not lend themselves to statistical

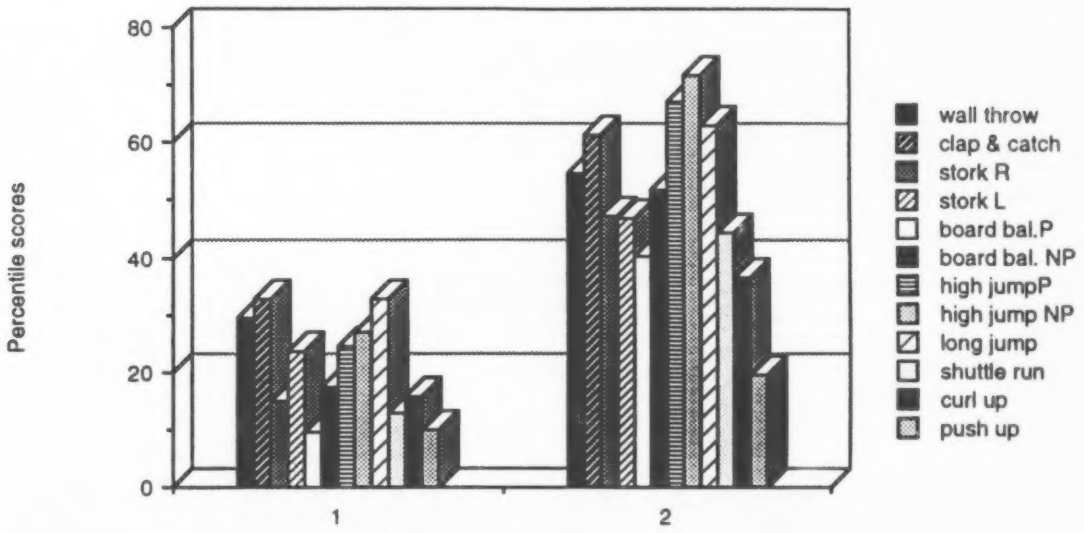


Figure 2. Differences in percentile scores on motor tests grades 1-3, PA=1, NA=2.

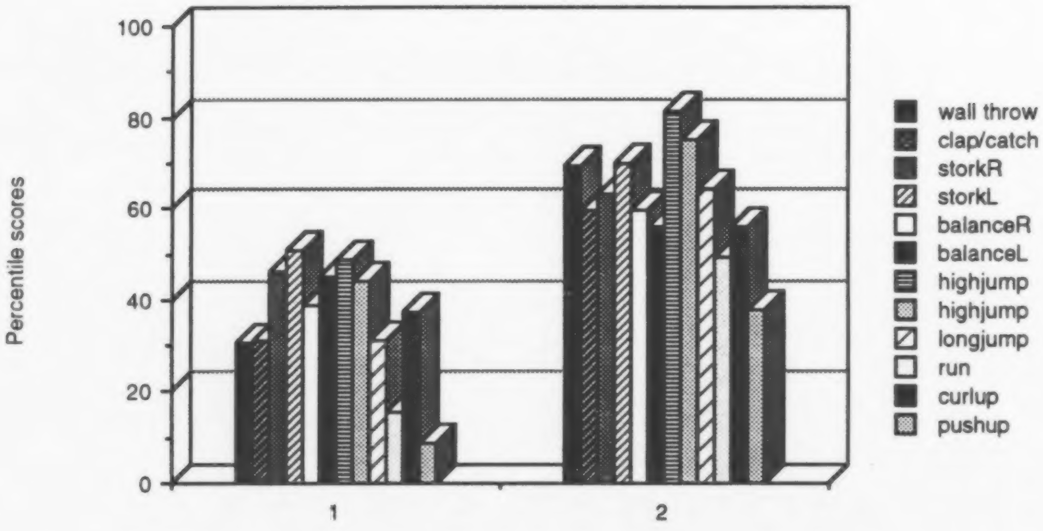


Figure 3. Differences in percentile scores on motor tests grades 4-6, PA=1, NA=2.

operations like averaging and correlating scores (Hopkins & Glass, 1978) therefore, a statistical analysis of the motor performances as measured by the Gross Motor Competence Test was done using the raw scores attained by the subjects. A 2 (group) x 2 (sex) analysis of variance on each motor task was used to determine if there were significant differences between the motor performance scores on each motor task for the two groups of PA and NA subjects and to determine if sex was a source of variance. The subjects in grades 1-3 were grouped separately from the subjects in grades 4-6. The data for the grade groupings were examined separately because the items on the MDRS addressed age-appropriate skills which were different for younger than for older children and it was therefore logical to treat the groups of younger and older children as two samples.

Provision for the unequal numbers of boys and girls at the grade 1-3 level was handled by using a hierarchical approach to the analysis in which the main effects are assessed first and the other interaction is set aside or held constant. The main effects are then held constant while the interaction is assessed.

A significant main effect was found for awkward versus controls ($p < .05$) on 11 of the 12 motor and fitness tests for the grades 1-3 subjects (Appendix F). The differences in performance were highly significant establishing a clear difference between the motor performance of the awkward and non-awkward groups on the Gross Motor Competence Test (Appendix F). One dynamic balance task however, the wide board balance for the left foot, did not discriminate between the grades 1-3 PA and NA subjects (F = 3.23, $p < .078$, Appendix F).

The grades 4-6 control group scored significantly better than the experimental group ($p < .05$) on 10 out of the 12 tasks on the Gross Motor Competence Test (Appendix G). The performance differences between the PA and NA were highly significant for those 10 tasks (Appendix G). The stork stand tests showed no significant differences. These static balance tasks, the stork stands, did not prove to be as discriminating as the other motor tests. It can be said, however, that the teachers' initial "Yes" answers on the MPRS identified a group of physically awkward school children in grades 4-6 in accordance with 10 specific motor tests on the Gross Motor Competence Test battery used.

Differences in the motor performance of boys and girls

One of the sub-problems posed in this study was whether male subjects who are teacher-identified as PA would perform gross motor skills differently from teacher-identified female subjects in accordance with the Gross Motor Competence Test. In the grades 1-3 sample a main effect due to sex was found on one fitness task. The main effect for sex on the long jump (F = 10.26, $p < .002^{**}$, Appendix F) indicated that boys and girls performed differently on this task. Since a significant difference between the groups and sexes was established it allows further comparisons to be made for the group of teacher-identified PA boys and girls only (Howell, 1989, Chapt.16). This procedure is referred to as Fisher's Least

Significant Difference Test and it involves a modified or *protected* t-test comparing the means of each group and using the Mean Square error and the error degrees of freedom from the analysis of variance for all 4 cells. Thus a conservative estimate of differences is produced. The results showed that the grade 1-3 PA males performed significantly better than the PA females (Table 2). No interaction for sex was recorded on any of the motor or fitness tests in this younger group.

Table 2. Fisher's LSD test showing differences between male and female PA, grades 1-3 on the long jump.

Long Jump			
males (n=18)	Mean =	119.17 cm	
females (n= 9)	Mean =	95.39 cm	
	MS error =362.83		df error = 50, 3
critical t = 2.009	at p < .05		obtained t = 3.05*

No interactions were found for the grades 4-6 subjects either. However, there was a main effect due to sex on two tests at this grade level. The scores of boys and girls were significantly different on the wide board balance for the right foot (F = 8.38, P < .005**, Appendix G) and there was an even greater difference between boys and girls on the wide board balance task for the left foot (F = 9.91, P < .003**, Appendix G). Protected t-tests were applied to the scores for the PA only and the teacher-identified girls scored significantly better than the teacher-identified boys on these balance tasks (Table 3). The NA girls had higher mean scores on both of these dynamic balance tasks (right = 8.97, left = 8.81) than the NA boys (right = 7.67, left = 7.13) but the significant difference was between the PA boys and girls. Teacher-identified PA girls were better at these balance tasks than PA boys in the current study suggesting that the wide board balance test (Stott, Moyes & Henderson, 1972) may be a good discriminator of awkward boys rather than girls in this age group.

Table 3. Fisher's LSD test for differences between grades 4-6 male and female PA subjects on the wide board balance tasks.

Wide board balance, right foot

PA males (n = 16) Mean = 5.76 (seconds)

PA females (n = 15) Mean = 7.99 (seconds)

MS error = 5.75 df error = 58, 3

critical $t = 2.009$ at $p < .05$ obtained $t = 2.59^*$

Wide board balance, left foot

PA males (n = 16) Mean = 5.57 (seconds)

PA females (n = 15) Mean = 7.78 (seconds)

MS error = 5. 93 df error = 58, 3

critical $t = 2.009$ at $p < .05$ obtained $t = 2.54^*$

Scores on the Rating Scales

Analysis of scores

A 2 (group) x 2 (sex) analysis of variance was completed for each item on both rating scales to determine if the teachers rated the PA and NA subjects significantly different and if there were any effects for sex in the rating scores. The scores for the grades 1-3 and grades 4-6 were analysed separately. An hierarchical approach to the data was used. In this approach to an ANOVA, the main effects for group are calculated first while the interaction is held constant. The main effects are then held constant while the interaction is assessed.

MPRS

There were highly significant differences between the ratings given to the grades 1-3 PA and the NA subjects for every item on the MPRS (Appendix H, Part 1). No differences were found for sex and no interactions were recorded.

Very significant differences were recorded for the grades 4-6 PA and NA subjects on the MPRS (Appendix H, Part 2). A main effect due to sex was found on item number 6 which asked if the child looked for chances to be active (Appendix H, Part 2). The PA boys scored significantly higher than the PA girls on this item (protected $t = 2.89^{*}$ $p < .05$). An interesting main effect due to sex was found on the item asking the teachers to rate the balance skill of their students (item #8, Appendix H, Part 2). The teachers' ratings on this item seemed to be in concordance with the differences found in the performance of dynamic balance tasks in which grades 4-6 PA girls scored significantly higher than the PA boys (Table 3). The difference between PA girls' mean score (2.0) on this rating scale item was not statistically higher (protected $t = 1.78$ $p < .05$) than the PA boys' mean score (1.6). There was little difference in the mean scores of NA boys and girls on these 2 items (Item #6, girls = 3.8, boys = 3.9; item #8, girls = 3.9, boys = 3.5).

The teacher responses on the MPRS rated the NA subjects as significantly more skilled in motor performance in both grade groupings (Appendix H, Part 1).

MDRS

The scores on the longer MDRS showed the same wide differences between teacher-designated PA and control subjects in both grades groupings for every item on the scale (Appendix J, Part 1 & 2). There was one main effect due to sex in grade 1-3 (Appendix J, Part 1) on item number 12. This item asked about skill in handling small apparatus like hoops and ropes. The low ratings that the teachers gave to the PA girls on item number 12 indicate that according to their observations these girls had very little skill in handling small apparatus. The PA girls mean scores were lower (1.5) than the PA boys (1.75) on this item.

There was a main effect for sex on 3 items on the MDRS for the grades 4-6 subjects (Table 4). The PA girls were rated lower than the PA boys in every case that a main effect showed significant differences between boys and girls (Table 4). The PA boys scored significantly higher ($p < .05$) than PA girls on all 3 items (Table 4). There was little difference between the ratings for NA boys and girls (Table 4).

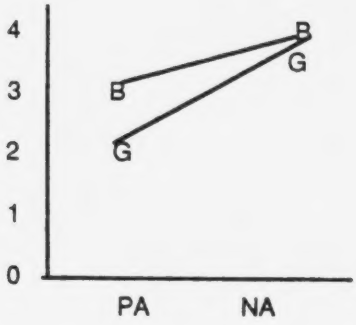
Table 4. Items on the MDRS with a main effect due to sex grades 4-6.

	PA				NA			
Item	Boys	SD	Girls	SD	Boys	SD	Girls	SD
1. Likes P.E.	3.06	.97	2.07	.96	3.88	.38	3.87	.34
2. Group play	2.63	1.2	1.80	1.2	3.88	.54	3.73	.46
3. Effort	2.38	.81	1.47	.74	3.81	.60	3.73	.49

1. Likes P.E. PA boys and girls Protected $t = 3.64^*$
2. Group play PA boys and girls Protected $t = 2.05^*$
3. Effort PA boys and girls Protected $t = 2.66^*$

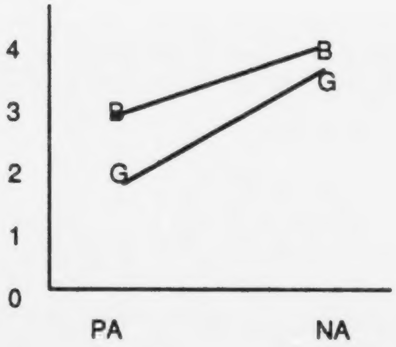
The purported variability in motor performance seen in physically awkward children (Wall & Taylor, 1984) is reflected in the teacher observations of the PA group which are also variable. The standard deviations are higher for the PA scores than for the NA scores on each item presented in Table 4. There was an interaction recorded for items number one ($p < .013^*$) and five ($p < .02^*$) on the MDRS (Appendix J, Part 2). Item one asked if the child liked physical education and item five asked about the effort put forth by subjects in physical activities. Figure 4 and 5 illustrate the interactions showing the low ratings teachers gave to PA girls for these 2 items.

The scales will next be assessed for reliability.



	Boys	Girls
PA	3.06	2.07
NA	3.88	3.87

Figure 4. Interaction effect on MDRS, item # 1 for grades 4-6. This item asked the teachers to rate the subjects on whether they looked forward to physical education classes or appeared to dislike physical education.



	Boys	Girls
PA	2.83	1.47
NA	3.81	3.73

Figure 5. Interaction effect on MDRS, item #5 for grades 4-6. This item asked the teachers to rate their students on whether they tackled physical tasks with intense interest and effort or seemed uninterested and easily frustrated by physical tasks.

PHASE 2: Assessing Reliability

Reliability

The central question of this study revolves around the development of rating scales to be used by regular elementary teachers of physical education to identify physically awkward children in their classes. The Motor Performance Rating Scale (MPRS) and the Motor Development Rating Scale (MDRS) were used by teachers in this study to rate the gross motor performances of students within the same sample. The rating scales must first prove to be reliable and valid to determine their usefulness in screening procedures.

Internal consistency is an estimate of the extent to which each test item measures the same construct as every other item on the scale. Internal consistency was examined by correlating the items on the MPRS and on the MDRS. A Biserial Correlation coefficient was calculated to determine the association between each item and the total test score for each scale. This method of estimating internal consistency requires that each item be removed in turn in order to correlate it with the total of the other items on the scale. Each item should correlate positively with the total test, the higher the better. The correlations can also be used to select the best items for revising the rating scales for future screening procedures. Four separate analyses were conducted on each rating scale to determine internal consistency. The correlations were done for the PA and NA subjects separately and the items on the rating scales for grade 1-3 students were analysed separately from the grade 4-6. This procedure provided a conservative estimate of internal consistency because the groups were homogeneous being made up of either all PA or NA subjects.

Rating scales must be reliable before they can be valid. There are two main sources of error in measurement. There are sampling errors and errors due to the circumstances surrounding the administration of the measuring process. Sampling error often results from the magnitude of the number of facets representing a construct such as physical awkwardness. A syndrome of physical awkwardness is characterized by low self-esteem, poor motivation, difficulty with fine motor activities or behavioural problems in addition to a lack of gross motor skill. The rating scales used in this study concentrate on gross motor competence which narrows the band of sampling error in this respect. The MPRS and the MDRS were both designed to be used by teachers as screening devices but they are very different because of length, detail and the provision made for progressive skill development on the MDRS. They could not therefore be considered parallel forms of the same test. The rating scales had to be treated as 2 different screening situations in order to determine internal consistency or reliability. Hoyt's method of estimating reliability can be used on a one-time application of a test or rating scale. A Hoyt estimate of reliability is a post-hoc analysis of variance calculated, not on the observed scores, but on the score variances and the error variance of the total scores. Reliability reflects the accuracy of the measuring process and while perfect reliability would be equal to 1.00, if the scale or test is designed for assessing the performance of individuals, a Hoyt reliability coefficient of .85 on the total scale would be satisfactory.

The standard error of measurement is an added index of test quality in that the error scores reflect the amount of error contained in the subjects' total scores on the rating scales. Low error scores indicate reliability.

Reliability of the MPRS.

The rating scales were recorded as quantitative input using a likert scale with scores from 1 to 4. The MPRS contained ten items asking the teachers of physical education to rate their students on commonly observed motor activities such as running, throwing, and balancing. The same scale was used for all grades. The biserial correlation coefficients for each item for grades 1-3 for both NA and PA can be seen on Table 5. Correlations of .50 or .60 are considered fairly high in the behavioural sciences (Pagano, 1986). Nine items out of the 10 were correlated at .50 or above for the NA subjects but only 4 items had correlations above .50 for the grades 1-3 PA subjects on this scale. Item number nine asking about playing with friends had a correlation of .87 for the NA and .39 for the PA (Table 5). The only item that had similar correlations for the PA and NA groups was the item asking about balance (# 8). Very few of the items for the MPRS were highly correlated with the total test scores for the PA subjects. Hoyt's estimate of reliabiltiy for the PA on the MPRS was .75 but indicated a much better reliability for the

Table 5. Reliability of items on MPRS, Grades 1-3, PA (n = 27), NA (n = 27).

	Mean		SD		Biserial Correlation	
Item	NA	PA	NA	PA	NA	PA
1. running	3.59	2.01	.64	.56	.65	.19
2. catching	3.52	1.89	.64	.64	.73	.21
3. throwing	3.44	1.93	.64	.47	.70	.31
4. ball games	3.67	1.74	.73	.81	.80	.52
5. climbing equip.	3.71	1.93	.54	.99	.47	.64
6. likes activity	3.67	1.78	.48	.69	.74	.52
7. fitness	3.52	1.96	.51	.59	.61	.41
8. balance	3.44	1.67	.51	.62	.60	.56
9. plays/peers	3.78	2.04	.42	.76	.87	.39
10. learns quickly	3.74	1.78	.45	.51	.79	.31

Hoyt estimate of reliability for NA = .91
PA = .75

Standard error of measurement (total score = 40) for NA = 1.19
PA = 1.80

Table 6. Reliability of the MPRS, NA (n = 31) & PA (n= 31), Grades 4 - 6.

	Mean		SD		Biserial Correlation	
Item	NA	PA	NA	PA	NA	PA
1. running	3.90	1.74	.30	.73	.85	.54
2. catching	3.77	1.68	.49	.59	.78	.58
3. throwing	3.74	1.71	.51	.78	.70	.45
4. ball games	3.94	1.87	.25	.89	.58	.72
5. climbing equip.	3.47	1.74	.71	.82	.34	.52
6. likes activity	3.87	1.91	.34	.79	.68	.62
7. fitness	3.94	2.07	.25	.85	.35	.59
8. balance	3.68	1.81	.54	.79	.59	.57
9. plays/peers	3.97	2.09	.18	1.0	.54	.79
10. learns quickly	3.97	1.81	.18	.65	.54	.41

Hoyt Estimate of Reliability for NA = .83
PA = .86

Standard Error of Measurement (total score = 40) for NA = 1.01
PA = 1.87

NA at .91 on this rating scale.

The standard error of measurement (SEm) is presented (Table 5) because the teachers rated their students only once on each scale and thus the observed score is an estimate of the true score that teachers might give to a student over repeated observations. Use of the SEm can establish a scoring range within which the true score probably lies. The total scores on the rating scales therefore are best represented as the observed score, plus or minus (±) the SEm. The SEm calculated on the total score for the NA on the MPRS was 1.19 and 1.8 for the PA subjects so that each NA subject's total score out of 40 would be accurately represented by their observed score ± 1.19 and each PA subject's observed score ± 1.8.

The correlation for items on the MPRS were higher for the grades 4-6 PA subjects than they were for the younger PA subjects. Item number five was low for the NA at .34 (Table 6). Teachers omitted rating 7 of the NA grade 4-6 students on the item (#5) concerning climbing perhaps because it was not observed as often as the other motor behaviours. This item dealing with climbing (item #5) had a correlation of .52 for the PA subjects (Table 6). Hoyt's estimate of reliability was at an acceptable .83 for the grades 4-6 NA and .86 for the PA subjects on this scale. The SEm for the NA was 1.01 and 1.87 for the PA subjects.

Reliabilitiy of the Motor Development Rating Scale

The MDRS had different versions for grades 1-3 and 4-6 to account for the progressive nature of expected motor skill development in children. Biserial correlations for each item for the PA and NA in grade 1-3 were calculated. There were 17 out of the 24 items for the NA and 11 for the PA subjects with correlations above .50 (Table 7). Item number three which asks about interaction with classmates in physical education had a correlation of only .01 (table 7) for the NA subjects leading one to think that this is a poor item to include in a rating scale. Another low correlation recorded for the PA and NA subjects was for item number fifteen which asks about moving with control and confidence about the gymnasium between apparatus and other people. This item was correlated at .18 for the NA and .36 for the PA subjects (Table 7). Items on ball skills (items 19-24) had very high correlations for the NA subjects and 2 items concerning running (#7 & #8) had fairly high correlations for both NA and PA subjects (Table 7). The Hoyt Reliability coefficients were higher on the MDRS than the shorter MPRS. The MDRS had a reliability estimate of .91 for the NA and .90 for the PA. The SEm for the NA on this rating scale was 1.65 based on a total score of 96 and the SEm was 3.20 for the PA subjects. This longer scale is probably a more reliable instrument than the 10-item MPRS for use in screening physically awkward children in grades 1-3 according to the acceptable biserial correlations, the high Hoyt estimate and the low SEm.

The correlations were positive and fairly high for all items on the MDRS for grades 4-6 for both the NA and PA subjects (Table 8). The lowest correlation for the PA group was .51 for item number three asking about interaction with classmates (Table 8). The first 5

Table 7. Reliability of Items on MDRS Grades 1-3 (27 PA & 27 NA).

Items	Mean		SD		Biserial Correlation	
	NA	PA	NA	PA	NA	PA
1. likes P.E.	3.93	3.11	.27	.97	.52	.35
2. enjoys group play	3.96	2.67	.19	1.1	.67	.43
3. interacts in group	4.00	2.67	.01	.96	.01	.43
4. follows directions	3.82	2.33	.48	.78	.40	.29
5. tries hard	3.93	2.15	.27	.82	.37	.52
6. runnning	3.82	1.48	.39	.58	.64	.46
7. runs fast	3.63	1.48	.57	.58	.69	.76
8. agile	3.83	1.56	.42	.69	.57	.64
9. rhythm	3.59	1.41	.55	.51	.38	.43
10. jumping	3.59	1.71	.55	.82	.51	.58
11. climbing	3.85	1.91	.36	.98	.32	.69
12. balls/hoops/etc.	3.89	1.63	.32	.49	.64	.51
13. lg. apparatus	3.85	2.02	.36	.93	.61	.57
14. takes risks	3.74	1.56	.45	.85	.54	.76
15. controlled	3.85	1.83	.43	.57	.18	.36
16. confident	3.93	1.63	.27	.79	.50	.81
17. fwd. roll	3.85	1.59	.36	.79	.61	.16
18. fears upsidedown	3.83	1.78	.42	.73	.45	.79
19. bounce ball	3.82	1.78	.48	.81	.75	.59
20. ball control	3.82	1.63	.48	.69	.73	.36
21. eye on ball	3.85	1.96	.46	.76	.60	.34
22. catching	3.85	2.06	.46	.86	.61	.34
23. throwing	3.78	1.96	.51	.76	.75	.43
24. run & kick	3.89	1.89	.32	.68	.67	.47

Hoyt estimate of reliability for **NA = .91**
PA = .90

Standard Error of Measurement based on total score of 96
NA = 1.65
PA = 3.20

Table 8. Reliability of Items on MDRS, Grades 4-6 (31 PA & 31 NA).

Items	Mean		SD		Biserial Correlation	
	NA	PA	NA	PA	NA	PA
1. likes P.E.	3.87	2.58	.34	1.12	.876	.67
2. group games	3.81	2.58	.48	1.21	.912	.76
3. interacts	3.77	2.03	.56	1.08	.921	.51
4. listens	3.71	2.07	.59	.96	.906	.58
5. effort	3.77	1.94	.49	.89	.819	.75
6. lg. apparatus	3.81	1.81	.48	.91	.787	.54
7. running	3.61	1.71	.62	.82	.864	.64
8. rhythm	3.61	1.74	.72	.99	.746	.79
9. power-jump	3.71	1.77	.53	.85	.503	.73
10. distance jump	3.68	1.84	.65	1.01	.516	.71
11. jump-landing	3.57	1.84	.64	1.04	.503	.80
12. action series	3.91	2.23	.30	1.12	.567	.86
13. fwd. roll	3.74	1.91	.51	1.05	.625	.74
14. control	3.84	2.07	.37	1.03	.618	.77
15. inverted	3.84	2.13	.42	1.09	.585	.77
16. climbing	3.84	2.17	.25	.87	.674	.86
17. ball control	3.88	1.84	.45	.96	.827	.81
18. striking	3.84	1.97	.45	.91	.827	.80
19. throwing	3.66	1.97	.57	.95	.660	.77
20. catching	3.74	1.97	.51	.98	.828	.76
21. group games	3.84	1.97	.37	1.05	.897	.87
22. part of action	3.84	1.68	.45	.95	.874	.78
23. series of plays	3.65	1.97	.66	.84	.891	.83
24. team player	3.74	1.98	.58	.92	.868	.68

Hoyt Estimate of Reliability for NA = .97
PA = .97

Standard Error of Measurement for total score of 96
NA = 1.64
PA = 3.15

items concerning attitude, or affective knowledge about action, had exceptionally high correlations for the NA subjects and they also had good correlations for the PA subjects (Table 8). The items concerning ball skills (items 17-24) were highly correlated for both groups of subjects. The Hoyt Estimate of Reliability on the MDRS was high at .97 for both the PA and the NA subjects and the SEm was low on a total score of 96 at 1.01 for the NA and 1.87 for the PA. On the basis of internal consistency the MDRS can be recommended as a reliable screening instrument for grades 4-6 school children.

Reliability of items on the MDRS concerning affective knowledge

At the outset of this study it was not intended to include items on the rating scales that ask teachers to rate behaviours other than gross motor skills as outlined in the Methods section of this paper. Recommendations from the Pilot Project (Appendix E) suggested dropping items about student participation in physical education because, according to Cronbach (1970), items perceived as a reflection on teaching ability will not be answered objectively. It had also been reported by previous researchers (Reynard, 1975; Calkins, 1977) that checklist items concerning social behaviours produce confusion in the identification of physically awkward children. In spite of these prior reports it was finally decided to include 5 items requiring teachers to rate their students on affective knowledge about action. Items about affective knowledge, or feelings and attitudes, were listed in the first section entitled General Impressions on the MDRS (Appendix B). The rationale for including these items was the fact that information concerning a child's acquired affective knowledge base about action would be important for follow-up remediation. Teacher input from a screening procedure that gathered information about affective knowledge would be invaluable if remediation were available.

For purposes of analysing the relationship of the 5 items tapping affective knowledge about action the MDRS was divided into 2 subtests and biserial correlations were re-calculated for a 5-item and a 19-item MDRS. Those first 5 items proved to be very consistent for the older children (grades4-6) with a Hoyt estimate of reliability at .95 for the NA and .92 for the PA subjects (Appendix K, Part 2). The Hoyt estimate for the younger children (grades 1-3) was .87 for the PA but very low for the NA at .31 (Appendix K, Part1). The SEm on these 5 items with a total score of 20 was only .55 for the younger NA but the the items do not have high correlations (Appendix K, Part 1). The correlations for the other 19 items changed very little by separating the scale into 2 parts although Cronbach's Alpha for composite comparing the variances between the 3 scales; the MPRS, the 5-item MDRS and the 19-item MDRS showed a fairly good reliability at .73 for both the grades 4-6 PA and NA subjects (Appendix K, Part 2) The SEm was low for the NA at .42 but was a fairly high at1.2 for the PA on a total score of 20 which does not indicate good reliability. There were interactions found earlier with an ANOVA on items number one and five (Appendix J, Part 2) casting doubt on the significance of their discriminating power. It was found that PA girls received very low scores from their teachers on items one (likes P.E.) and five (exerts effort) on the MDRS (Table 4). A breakdown of the scores by grades and sexes on these items is presented in table 9. The NA boys and girls were given similar scores by their teachers and the male and female PA subjects in grades 1-3 also had similar ratings. The teacher-identified girls in grades 4-6 were rated lower than any other group according to these scores (Table 9).

Table 9. Mean scores and standard deviations on 2 affective items on the MDRS.

Group	Mean Item#1 (likes P.E.)	SD	Mean Item#5 (effort)	SD
PA girls grades 1-3	3.0	.81	2.3	.96
PA boys grades 1-3	3.0	.75	2.1	.81
NA girls grades 1-3	3.8	.26	3.8	.26
NA boys grades 1-3	3.9	.23	3.8	.28
PA girls grades 4-6	2.1	.83	1.5	.81
PA boys grades 4-6	3.1	.32	2.8	.83
NA girls grades 4-6	3.9	.28	3.7	.42
NA boys grades 4-6	3.9	.26	3.8	.33

The Item about effort seems to discriminate grades 1-3 students and PA girls but only the PA girls were rated low on whether they enjoyed P.E. or not.

Teacher consistency over two rating scales

Two rating scales were completed by 38 practising teachers from 6 different schools in this study. The consistency of those teachers observing the same subjects on 2 occasions can help to estimate reliability. Hoyt's ANOVA was used to estimate internal consistency and Cronbach's Alpha for composite was then applied to compare the totals on the 2 tests. Cronbach's Alpha compares the variance of one test with the variance of the other to estimate reliability. Teacher consistency rather than accuracy is being assessed with this statistic because the alpha is a measure of the covariances and not of the traits being measured. The same teachers rated the same sample of children on 2 occasions within a period of 3 weeks to a month and the total test reliability estimates on the 2 rating scales over these 2 occasions is presented in Table 10. The MPRS was assigned a total score of 40 and the total score for the MDRS was 96. It can be seen that the error scores are low in terms of total scores but the standard error is greater for the PA subjects. The teachers ratings were more variable for the PA subjects than for the NA subjects. The relationships between the 2 scales, as estimated by Cronbach's Alpha, are influenced by the homogeneity of the groups of awkward and non-awkward subjects being assessed. The estimates of reliability are conservative due to these restricted groups and are therefore lower than would be expected from a cross-section of a normal population. The teacher consistency over 2 occasions for the 58 teacher-identified subjects in both grade groups (PA) was found to be higher (.79) and thus more reliable than when the younger and older subjects' scores were correlated separately (Table 10).

Table 10. Consistency of teacher ratings on the MPRS and the MDRS.

	Hoyt's Estimate internal consistency				Cronbach's Alpha consistency on 2 scales
	MPRS	SEm	MDRS	SEm	
Grades 1-3 PA	.75	1.2	.91	3.2	.60
Grades 4-6 PA	.86	1.9	.97	3.2	.61
Grades 1-3 NA	.91	1.8	.90	1.7	.64
Grades 4-6 NA	.83	1.0	.97	1.6	.61
All PA grades 1-6	.97	1.6	.99	2.9	.79

The rating scales have proved to be quite reliable according to these outcomes and recommendations for improving these instruments will be made based on the extent of confidence that can be placed on each scale. The SEm was lower for the MDRS indicating that this rating scale might be the more reliable of the two.

PHASE 3: Teacher Accuracy in Identifying Physically Awkward Children

Validity

The development of instruments that will help to identify physically awkward children is made especially difficult because an acceptable method of accurately identifying such children does not currently exist. The construct of physical awkwardness as defined in this study depends on the adequacy of performing age-appropriate culturally-normative motor skills and teachers were asked to rate the children in their physical education classes by comparing their motor skill development to that of their peers. The rating scales devised for this study were intended to help teachers focus on expected age-appropriate and culturally-normative motor skill development.

Validity refers to the accuracy with which a test measures what it is intended to measure. Validation is a continuous process with the use of instruments such as motor tests and rating scales. Thus the definition of physical awkwardness continues to evolve as more research and programs are implemented.

Content validity was established by referring to experts in the field of teaching. Predictive validity was addressed by using the Gross Motor Competence Test as a criterion against which to judge the accuracy of teachers' observations on the rating scales.

Content Validity

Professional judgment can be used to establish content validity. Basic considerations concerning content are:

1. The agreement about expected skill development.
2. The degree that the scale items overlap the instruction being offered.
3. The inclusion of only those items that are relevant to gross motor development.

Factors that are incidental to the main focus should not be included in a screening instrument. A slight compromise on incidental factors was made by including 5 items on the MDRS referring to affective knowledge about action because it was felt that these items might be useful for designing remedial programs and also that they might help in the continuing process of defining physical awkwardness.

Content validity was established by referring to 9 practising elementary teachers and 6 Education professors in the process of constructing the rating scales (see Methods). The teacher-experts suggested asking about more general skills than specific skills such as "stick handling" and this suggestion was implemented in designing the items. An additional 3 teacher-experts were asked to read and comment on the final draft of the rating scales to be sure the content was relevant and appropriate. Detailed descriptions of skilled behaviour and the opposing unskilled behaviour were incorporated into each item on the MDRS to help teacher observers focus on the quality of motor performance. These descriptions were considered accurate by the experts consulted. In order to have classroom teachers cooperate in the implementation of a program Fullan (1984) states that the teachers must be able to relate to the rationale and the termonology used in the procedure. It was judged by the professionals that most teachers would understand the purpose of the screening procedure, the wording of the items and the specific motor behaviours to be rated. The teacher-experts also agreed that orientation with the teachers involved in the project would help to produce a mutual understanding of physical awkwardness. Furthermore, the items on the scales were drawn from Alberta Education's (1983) curriculum outlines in order to ensure agreement between the items and the skill instruction offered in physical education classes. The 3 professional experts agreed independently that the final draft of both rating scales included the basic considerations of expected skill development and relevance to the program. They accepted the first 5 items on the MDRS that referred to affective knowledge about physical activity realizing that these items concerned some of the social behaviours thought to be exhibited by physically awkward children and not by children who are competent in gross motor skills. One can be confident that the content of the scales was valid considering the knowledgeable judgment of the teacher-experts.

Teacher Accuracy: A Criterion-Reference

Teacher accuracy on the motor tests

The main question of this research project is: can regular teachers of elementary physical education identify children in their physical education classes who are physically awkward in accordance with the Gross Motor Competence Test? Rating scales were designed to help the teachers in the screening procedure. The question of accuracy will now be addressed by using cut-off procedures to classify the subjects as awkward or non-awkward.

The raw scores obtained from the motor test results were transformed into stanine scores in order to place the subjects into physically awkward and non-awkward categories. The use of stanine scores allows probability statements to be made about scores expected within a normal population because the stanine scores represent a standardized distribution (Howell, 1989) which forces the data into equal intervals except for the extreme ends of the scale, for example; stanines one and nine. Transformations of data to standard scores such as stanines can more nearly satisfy the assumption of normality and clarify the statistical outcomes (Dixon & Massey, 1983) for the range of age groups that are included in this study. Stanines make it possible to compare students' performances on the tests included in the Gross Motor Performance Test in which scores are recorded in very different measures such as time, distance or number of completed tasks because stanine scores can be added together to obtain a composite score (Gronlund, 1985).

The use of stanines in the current study provided an easier method of classifying the performances of both the PA and NA subjects on the motor skill tasks than the profile analysis such as that used in the pilot study (Appendix E). In the pilot study (Appendix E) students were placed in the category of physical awkwardness if they scored below the tenth percentile on 4 or more motor tests. Post-hoc professional judgement was needed in addition to this criterion, to decide if overall low scores warranted a classification of physical awkwardness (Appendix E).

Stanine scores were derived from the cumulative frequency of the raw scores recorded for the subjects in this study. A decision about a cut-off score to classify subjects as awkward or non-awkward was derived from the frequencies of the composite mean stanine scores for all subjects. In examining the results for an optimum cut-off score it can be seen that the frequencies of the teacher-identified PA and NA fall into two distinct groups of scores (Figure 6). A composite score in stanine 4 might be a good cut-off point for grades 1-3 judging by the frequency of scores in this stanine (Figure 6). Typically a difference of two stanines represents a significant difference in scores. Scores in stanine 3 would thus be one standard deviation below the median scores represented by stanine 5. The first three stanines encompass the lower 23% of the cases in any selected group. It was decided therefore to accept stanine 3.99 as a cut-off score for this study to classify subjects as awkward or non-awkward in grades 1-3. If

Figure 4. Frequency of mean stanine scores on motor tests, grades 1-3.

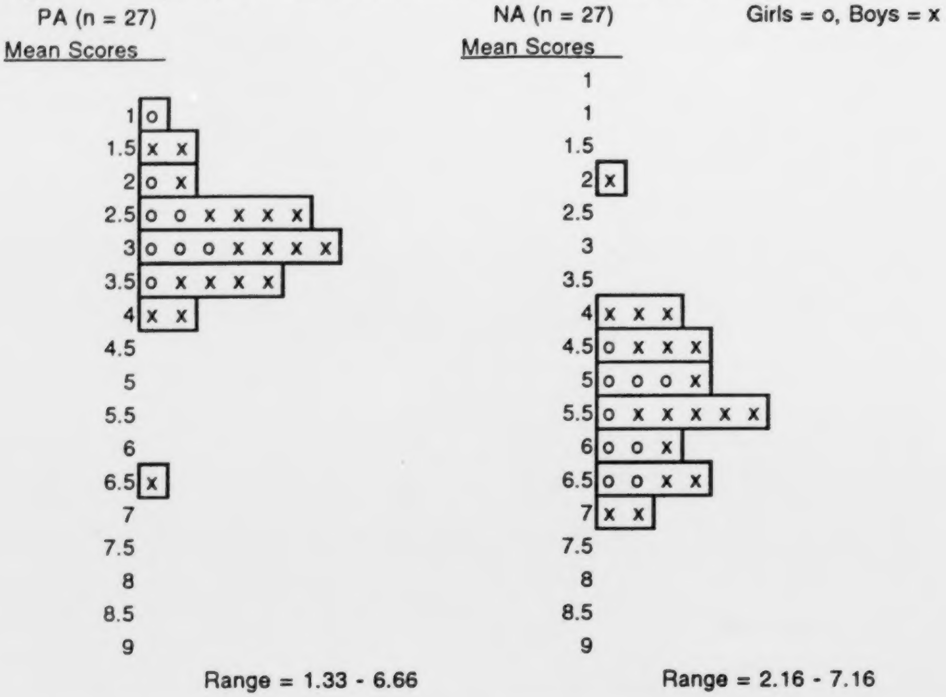
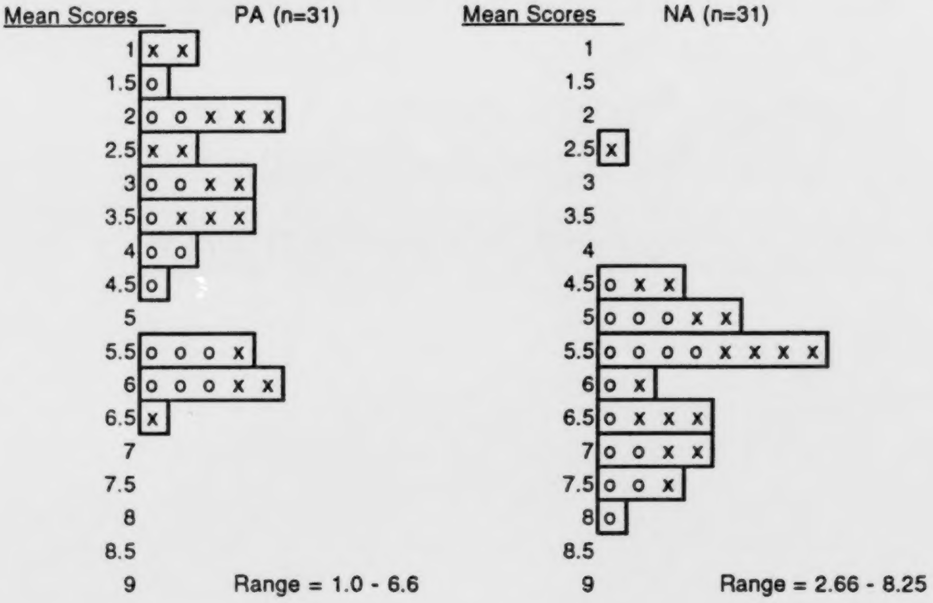


Figure 5. Frequency of stanine scores on motor tests, grades 4-6.



remediation were the intent of the screening procedure then a different cut-off score might be used. According to this criterion the teachers were correct in their choice of 24 out of 27 PA students in grades 1-3. There were 26 out of 27 students in the NA group who could be classified as non-awkward.

It can be seen in figure 7 that most of the control subjects in grades 4-6 had mean composite scores at stanine 4.5 or above. An optimum cut-off score should include as many subjects as possible in each group in order to determine the effectiveness of the teachers in the screening procedure thus stanine 4.49 was chosen as the optimum cut-off score for classifying grades 4-6 subjects as awkward or non-awkward. Stanine 4.5 and up would include the top 69% of the scores. According to this criterion the teachers were correct in their choice 20 out of the 31 teacher-designated PA subjects in grades 4-6 could be classified as physically awkward (see Table 11) and 30 out of 31 control subjects could be classed as non-awkward. The teachers were very accurate in designating PA children in grades 1-3.

The teachers missed identifying one male control subject out of 31 NA children as physically awkward. If this sample could be used as a guide, the teachers screened most of the PA children in this age group. However, 11 of the older students identified as physically awkward did not have mean stanine scores that would place them in the awkward category (Table 11). It is possible that the teachers are not as effective in recognizing children with gross motor

Table 11. Teacher accuracy according to the motor tests results.

Teacher-identified PA	Confirmed PA	Unconfirmed PA/NA
grades 1-3 = 27	24 = 89%	3 boys
grades 4-6 = 31	20 = 65%	7 girls
		4 boys
Control Group, NA	Confirmed NA	
grades 1-3 = 27	26 = 96%	1 boy
grades 4-6 = 31	30 = 97%	1 boy

difficulties in grades 4-6. It is also possible that the motor test battery is less effective at discriminating gross motor competence in this age group.

There were some differences in the motor scores of teacher-identified boys and girls. In grades 4-6 there were 15 teacher-identified PA girls and 7 of them did not score below the stanine 4.49 on the motor test battery used. In addition, the groups of boys and girls in grades 1-3 differ from the older subjects in the performance of motor skills. There were twice as many boys as girls identified by their teachers in the primary grades. Only 9 PA girls were identified in grades 1-3 and all of those girls definitely had poor motor skills. Actually none of those 9 girls had composite scores higher than 3.5 on the motor test battery.

Teacher accuracy on the rating scales

Frequency graphs on total scores from each of the scales were examined to determine a cut-off score for designating subjects as awkward or non-awkward. The ratings teachers assigned to the experimental and control subjects for the MPRS illustrate two distinct groupings (Figures 8 & 9). The graphs with the total scores for the MDRS also fell into 2 easily distinguishable groups (Figures 10 & 11). The scores on both the MPRS and the MDRS can be surveyed at the same time to determine an optimum cut-off point for total scores to determine teacher effectiveness in rating gross motor performance. A total score of 26 or less on the MPRS appears to be most representative of the PA groups. The frequency graph for the MDRS indicates that a total score of 69 or the bottom 70% of the scores would be an good cut-off point for that scale. A cut-off score was therefore set at these points. The cut-off points were expressed in a range of scores rather than exact scores of 26 or 69 (Table 12). Observed scores are not really precise and allowance was made for the standard error of measurement in the cut-off procedures with the rating scales. The teachers rated their students only once on each scale therefore, the observed score is an estimate of the true rating score that a teacher might give to a student over repeated observations. Use of the standard error of measurement (SEm) can establish a scoring range within which the true score probably lies. There were different error scores for the PA and NA subjects. The SEm for the grades PA 1-3 subjects on the MPRS was

Figure 8. Frequency of total scores on the MPRS, grades 1-3.

Girls = o, Boys = x

Scores	PA (n = 27)	Scores	NA (n = 27)
10		10	
12	o x x	12	
14		14	
16	o o x x x x x x	16	
18	o o o x x x x	18	
20	o o x	20	
22	o x	22	
24	x x x	24	
26	x	26	o
28		28	x x
30		30	o x x
32		32	x
34		34	x x
36		36	o o o x x x
38		38	o x x x x
40		40	o o o x x x x
	Range = 13-27		Range = 26-40

Figure 9. Frequency of total score onthe MPRS, grades 4-6.

Scores	PA (n = 31)	Scores	NA (n=31)
10	o o o x x	10	
12		12	
14	o o o x x x	14	
16	o x	16	
18	o x x x	18	
20	o o o x x x	20	
22	o o o	22	
24	o x	24	
26	x x	26	
28	x	28	
30		30	o x x
32		32	
34		34	
36		36	o o x
38		38	o o o x x x x x
40		40	o o o o o o o o o x x x x x x x x
	Range = 10-28		Range = 30-40

Figure 10. Frequency of total scores on the MDRS, grades 1-3.

Girls = o, Boys = x

Scores	PA (n = 27)	NA (n = 27)
24-29	x	
30-34	o o x	
35-39	o x x	
40-44	o o o x x x x x x x x	
45-49	o x x	
50-54	o o x	
55-59	x x	
60-64		
65-69		
70-74	x	x
75-79		
80-84		o x
85-89		o x x
90-94		o o x x x x x x
95-96		o o o o o x x x x x x x x

Range = 24-73

Range = 73-96

Figure 11. Frequency of total scores on the MDRS, grades 4-6.

Scores	PA (n = 31)	Scores	NA (n=31)
24-29	o o o x x	24-29	
30-34		30-34	
35-39	o o o x x x	35-39	
40-44	o x	40-44	
45-49	o x x x	45-49	
50-54	o o o x x x	50-54	
55-59	o o o	55-59	
60-64	o x	60-64	
65-69	x x	65-69	o x
70-74	x	70-74	x
75-79		75-79	o
70-84		80-84	o
85-89		85-89	o x x
90-94		90-94	o o x x x x x x x
95-96		95-96	o o o o o o o o o x x x x x x

Range = 24-82

Range = 65-96

1.8 and thus a range for the cut-off score on the scales was set between 24.2 and 27.8 for this group (Table 12). This range of cut-off scores was used to establish the accuracy rate of the teachers' observations. If a teacher-identified subject was rated no higher than the established range for the rating scale then the identification of that subject was confirmed as PA but If a teacher rated a subject higher than the cut-off score then that identification was unconfirmed. Using this range of cut-off scores for the rating scales the numbers of subjects identified by their teachers is presented in table 13.

Table 12. The range of cut-off scores for the rating scales.

	MPRS		MDRS	
Grades 1-3	SEm	Range	SEm	Range
PA	1.8	24.2 -27.8	3.2	67.2 - 70.8
NA	1.2	24.8 -27.2	1.7	67.8 - 70.2
Grades 4-6				
PA	1.9	24.1 - 27.9	3.1	67.1 - 70.9
NA	1.0	25.0 - 27.0	1.6	68.0 - 70.0

It can be seen that a teacher sometimes misidentified a student. Misidentification means that a teacher-identified subject was subsequently rated with a score above the cut-off score selected for the MPRS or MDRS by that same teacher (Table 13).

Table 13. Teacher ratings on 2 scales.

Teacher-identified PA	Confirmed		Unconfirmed	
	MPRS	MDRS	MPRS	MDRS
Grades 1-3 PA (n=27)	23	26	4	1
Grades 4-6 PA (n=31)	25	23	6	8
Control Subjects NA				
Grades 1-3 NA (n=27)	27	27	0	0
Grades 4-6 NA (n=31)	31	29	0	2

Most of the discrepancies were with the PA groups. These misidentifications will be accounted for by using the Gross Motor Competence Test as a criterion against which to validate the teacher identifications. The ratings teachers gave to subjects can be assessed in three ways; correct, incorrect or a missed identification. An example of a correct rating would be when a teacher-identified (PA) child scored below the cut-off point on the rating scale and also on the motor tests. Another example of a correct rating would be a case in which a teacher identified a child as PA then rated the child as NA and the motor test results confirmed that NA rating. An example of an incorrect rating would be a case in which the PA subject was rated below the cut-off score for the rating scales and then scored above the cut-off score (stanine 3.99 for grades 1-3 and stanine 4.49 for grades 4-6) on the motor tests. If a child were designated as NA and subsequently had a composite motor score below the cut-off score then that subject would be considered a missed identification. The teacher accuracy rate is presented in these terms in Table 14.

With the use of the MDRS teachers have correctly identified the same number of PA as the motor performance tests for grades 4-6 PA. Some of the subjects who were identified by their teachers as PA were then rated by those same teachers with scores of 67 or above and those subjects also scored above a mean of 4.49 on the motor tests. This was counted as a correct rating and thus the MDRS was 65% correct in terms the Gross Motor Competence Test for the grades 4-6 PA.

The teachers seemed to be quite accurate at rating the PA in grades 1-3 although they missed identifying 1 boy who was in the control sample and who performed very poorly on the motor tests with a composite score of 2.16. The teachers appear to be very accurate at identifying grades 4-6 NA but not the PA. Nevertheless the rating scales helped the teachers to correctly identify a fairly high percentage of physically awkward children as confirmed by the Gross Motor Competence Test. Higher cut-off scores for the MDRS than those decided upon for this study would be more realistic in a school setting in order to include all children who might have motor problems and would benefit from remedial programs or counselling. In that setting the MDRS in particular would be a valid instrument to use in a screening procedure.

Table 14. Teacher accuracy rate using the MPRS and the MDRS.

	Numbers identified and accuracy rate based on the motor tests		
Group	MPRS	MDRS	Motor Tests
1-3 PA (n= 27	21 correct 5 incorrect	25 correct 2 incorrect	24 PA 3 NA
Accuracy rate	78 percent	93 percent	
1-3 NA (n = 27)	22 correct 4 incorrect 1 missed	25 correct 1 incorrect 1 missed	26 NA 1 PA
Accuracy rate	78 percent	93 percent	
4-6 PA (n = 31)	18 correct 13 incorrect	20 correct 11 incorrect	20 PA 11 NA
Accuracy rate	58 percent	65 percent	
4-6 NA (n = 31)	28 correct 2 incorrect 1 missed	29 correct nil 2 missed	30 NA 1 PA
Accuracy rate	90 percent	94 percent	

Accuracy on five affective items on the MDRS

The first 5 items on the MDRS asked teachers to rate their students on attitudes and feelings about physical activity. An analysis of variance uncovered an effect due to sex and an interaction effect on 2 of these items (#1 & #5). Item one asked if the child enjoyed physical education and item five asked if the child approached physical tasks with energy and effort. The younger groups of children had motor scores in accordance with their ratings on the scales and there was little difference between boys and girls (see Table 9, p. 95). The grades 4-6 PA girls were rated especially low on both items (Table 9). The PA boys were not rated as low as the girls (Table 9). Seven of the PA girls had composite motor scores above 4.49 and their teachers rated them quite low for these items (Table 15). The 8 truly awkward girls (PA) who scored below

Table 15. Accuracy rate on 2 affective items grades 4-6.

Group	Mean #1	Mean #5	Mean Motor Scores
PA girls (7NA)	2.42	1.85	5.79
PA girls (8PA)	1.75	1.50	3.15
PA boys (4NA)	2.50	2.75	6.24
PA boys (12PA)	3.50	2.50	2.68
NA girls (n=15)	3.87	3.73	6.31
NA boys (n=16)	3.88	3.81	5.54

4.49 on the motor tests in grades 4-6 were rated slightly lower by their teachers than the 7 girls (NA) who did not score below the cut-off point on the motor tests. The teachers' perceptions about girls in the teacher-identified group were not consistent with the girls' performance of gross motor skills. These rating scale items (#1 & #5) are therefore not valid discriminators of physically awkward girls. The items do not appear to be much better at discriminating physically awkward boys either. The 4 PA boys whose motor performance was quite competent (Table 15) were rated low by their teachers on these 2 items. There was some characteristic in those 4 boys that was not uncovered with the total MDRS nor with these 2 affective items. These findings concerning items on rating scales asking about attitudes and feelings have confusing results as previously found by Reynard (1975) and Calkins, (1977). Items on rating scales therefore seem to be more effective if they ask about culturally-normative gross motor activity.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Children with a syndrome of physical awkwardness exhibit both low and variable motor performance (Wall & Taylor, 1984). Identification of these children should involve an initial screening, an assessment of performance and an evaluation of each child's profile. The primary question of this study was to determine if regular teachers could conduct a screening procedure to identify children who are physically awkward within their normal physical education classes. Secondary considerations involved the use of a rating scale to help the teachers identify physically awkward children. Two rating scales were designed for this purpose; the Motor Performance Rating Scale (MPRS) and the Motor Development Rating Scale (MDRS).

The first question on the MPRS was, "Are you concerned for the motor development of this child? YES or NO?". The teacher did not complete the rating scale unless he or she perceived a lag in the motor development of a student. Fifty-eight elementary school children, within the delimitations of the current study, were identified by their teachers as physically awkward (PA). Twenty-seven of these children were in grades 1-3 and another 31 were in grades 4-6. In addition, the teachers rated a control group of students who were matched for age and sex with the teacher-identified PA children. There were 58 control or NA subjects, 27 in grades 1-3 and 31 in grades 4-6.

In the next stage of the screening procedure the teachers rated the controls and the experimental group of students with the help of the MDRS. All of the children, both PA and NA, were assessed with the Gross Motor Competence Test battery consisting of 12 motor performance tasks. Thus information was gathered from 4 sources about the 2 groups of children (PA and NA) who were selected from 6 elementary public schools in Edmonton. The 4 sources included the teachers' concern, the completed MPRS, the MDRS, and the Gross Motor Competence Test.

The teachers accounted for three qualitative observations. The results of the two rating scales were later converted to quantitative input using a likert scale. The motor test results were recorded quantitatively and the raw scores were converted to stanine scores in order to compute a mean composite score for each subject. Cut-off scores based on the composite motor scores were established at stanine 3.99 for the grades 1-3 subjects and at 4.49 for grades 4-6 subjects. If a child obtained a composite score below that cut-off point on the 12 motor tests then that child was designated as physically awkward by the researcher. The teacher observations on the rating scales were consistent with the findings from the motor test battery for 89% of the grades 1-3 PA children. The NA children, as a group, were rated significantly higher by their teachers and they performed significantly better than the group of PA children in grades 1-3 on 11 of the 12 motor tests. One dynamic balance task, the wide board balance for the left foot, did not discriminate sufficiently between the 2 groups. The NA subjects in grades 4-6 also scored significantly higher on the rating scales and on 10 out of the 12 motor tests. Reliability was established for the rating scales and the content was judged to be valid. Consistency was found between the teacher ratings on the scales and the findings from the Gross Motor Competence Test especially for the grades 1-3 subjects. The Motor Development Rating Scale was the more discriminating screening instrument of the two developed for this study.

Discussion

Gubbay (1975) felt that identifying children with motor problems below the age of eight was difficult and he eliminated them from his studies. Other studies found confusion in the assessment of primary-aged physically awkward children (Reynard, 1975; Calkins, 1977). It is interesting to note that physically awkward grade ones, who were seven years old, were identified fairly easily in the present study but not all children with motor problems were selected. One boy performed poorly on the motor tests but was not identified as PA by his teacher.

As stated, the teachers were quite accurate in their identification of physically awkward school children in the primary grades. Henderson and Hall (1982) also found the teachers of an "Infant School" in England to be accurate using their particular procedure but other researchers have not noted this accuracy. King and Dunn (1989) found that teachers were able to correctly identify only 25% of grades 1-4 students whose motor performance was the least proficient but were more accurate in the identification of skilled performance in their students. The teachers in their study, unlike the present study, were given no orientation before completing the observation reports about their students (King & Dunn, 1989). Both of these studies (Henderson & Hall, 1982; King & Dunn, 1989), included an aspect of fine motor control in addition to gross motor performance which lends a slightly different perspective to their results than what is sought here. Concentration on gross motor skill may have helped the teachers identify a high percentage of grades 1-3 subjects in this screening procedure.

Previous studies concerning the identification of physically awkward children also included an assessment of the fine motor problems that are frequently presented by PA subjects (Sugden, 1972; Gubbay, 1975; Taylor, 1982). This emphasis may have caused some of the confusing results reported by Keogh, et al. (1979) because some children may have specific fine motor problems while others have difficulty with both fine and gross motor activity. The current study focuses on children who have gross motor problems specifically. The results found in the current study show a higher success rate than previous studies possibly due to this orientation towards physical education and fitness.

While teachers were fairly accurate in identifying younger subjects with the current screening procedure there was some lack of agreement in the teacher ratings and the motor performance scores among grades 4-6 PA subjects. Furthermore, girls in this age group seemed particularly difficult to identify. Only 8 of the teacher-identified PA girls scored below the criterion set for awkwardness in this study yet there were 15 girls identified by their teachers as PA.

Teachers perceptions about the motor performance of girls in this age group may be clouded by the social patterns typical of pre-adolescent girls. Due to social pressures many girls in this age group do not want to mess their hair or to get dirty and sweaty. These girls can appear to be sedentary, unmotivated, or lazy. Judgements about behavioural attitudes also fail to take into account the type of activities older girls often seek. The skill expectations of both the researchers and the physical education teachers may not accurately reflect the genuine activity interests in this age group. The difficulty encountered in the identification of pre-adolescent girls might be attributed to physical education programs that do not meet the needs of all students. Girls in grades 4-6 are often attracted to dance, gymnastics, horseback riding, or activities that rely on social interaction and cooperation. These girls are usually compliant while at the same time avoiding participation in current physical education programs offered in schools. Some boys in this age group may also be more interested in the challenge of individual physical activities, outdoor pursuits or cooperative social projects than they are in the competitive sports usually offered in school physical education programs. It is not possible for teachers to observe their students except when they are performing motor skills offered by the current program. A different program might produce more intense participation on the part of grades 4-6 students and then a more accurate assessment of motor performance would be possible.

A possible explanation for the difficulty in identifying motor problems in grade 4-6 school children is that children who are physically awkward while in the primary grades may show an improvement in motor skills as they grow older and gain more procedural and declarative knowledge about action through experience with movement patterns. Recent hypotheses (Knuckey & Gubbay, 1983; Silva & Ross, 1980) surrounding the possibility of a developmental lag in motor performance suggest that children with less severe motor problems may improve their skill to acceptable levels of performance as they mature and gain more experience in physical activity. Children may catch up with their peers in the performance of motor skills or they may become more adept at avoiding situations requiring motor competence. On the other hand, it is possible that the improvement noted in older children reflects "the inability of tests to differentiate among older persons" (Wall, Reid & Paton, 1990, p. 292). The identification of older children who are expected to participate in complex games or sports would be improved by devising more sophisticated gross motor tasks that would include striking activities, reaction times and strategic behaviours.

Ten out of the 12 motor tests in this study discriminated between older awkward and non-awkward children. The stork stands did not illustrate sufficient differences between the PA and NA subjects in grades 4-6. The stork stand for the left foot was particularly easy for all subjects, PA and NA. The left foot is commonly used for balance in right-footed individuals and since only two PA and two NA children in this study were left handed, it seems likely that most subjects would have established good balance on the left foot.

One important finding in the present study was that boys and girls in grades 4-6 differed in their performance of the wide board balance test, a dynamic balance task. Teacher-identified girls performed significantly better than boys on this test. To be more accurate in the identification procedure, boys and girls should be required to perform some different motor tasks. Devising different motor tests for girls and boys may improve the differentiation among older persons that seems to be lacking in some of the motor tasks used in this study.

Conclusions

The central question of this study was: can regular teachers of elementary physical education identify children in their classes who are physically awkward? Given the fact that the scores this rating scale demonstrated clear differences between the groups of PA and NA children and that there was a distinct difference in each group's scores on the motor tests, we can accept that they represent 2 different samples at 2 grade levels. The teachers with the help of these rating scales were 89% accurate in the identification of physically awkward children in the primary grades (1-3) correctly identifying 24 out of 27 PA subjects. The teachers were correct in their identification of 65% of the 31 grades 4-6 PA students. A major conclusion drawn from this finding is that it is essential to use different instruments in the identification and assessment procedures for children in grades 1-3 than for those in grades 4 and above. The procedure was accurate with the younger students but different rating and motor test items seem to be needed to reliably identify older school children. The results found here however, are better than that found in previous studies. Gubbay (1975) reported a less than 50% accuracy rate on the part of the teachers with students aged 8-12. The rating scales devised for the current study may have helped the teachers to be more perceptive about the motor performance of their students.

In the current study the teachers were able to correctly identify more boys than girls in grades 4-6. It was also found that teacher-identified boys and girls performed dynamic balance tasks differently (Table 3). The wide board balance tasks proved to be good discriminators of PA boys. In addition, the teachers rated PA girls as having better balance than PA boys. One important conclusion that can be drawn from these results is that girls in junior grades (4-6) should be assessed separately from boys using a few different motor tests and rating scale items.

The MDRS was the more reliable of the 2 rating scales for teachers to use in the initial screening of physically awkward school children. A reliability coefficient of .90 was computed on the

MDRS for the PA in grades 1-3 and .91 for the NA in these grades. The reliability coefficient for the children in grades 4-6 was .97 for both the PA and NA subjects on the MDRS. The content of the rating scale was judged to be valid by a total of 12 elementary teachers and 6 Education professors at the University of Alberta. When examined in conjunction with the motor tests as an external criterion, the MDRS was found to agree 93% of the time for the PA in grades 1-3 and in 93% of the cases for the NA subjects. This rating scale is therefore a reliable and valid instrument for the screening of physically awkward children grades 1-3. There was a 94% agreement with the outcome of the motor tests and the MDRS for the NA grades 4-6 subjects and 75% agreement for the PA boys in this group. The MDRS was effective in screening 53% of the PA girls. The MDRS could be improved to screen both boys and girls in grades 4-6 more effectively.

The results of the study indicated specific improvements that can be made in the design of a detailed rating scale. The first five items on the MDRS dealt with students' attitudes and feelings concerning physical education classes. While low scores on these items may be typical of a syndrome of physical awkwardness they are not overtly observable motor behaviours. The items were designed to provide information about affective knowledge about action nevertheless, if a child has acquired a sound basis in procedural knowledge it should be overtly observable in gross motor skills and the affective knowledge may be assumed to be positive. These items did not prove to be reliable when the teachers rated the

NA grades 1-3 subjects (Appendix K) and they were not consistent with the motor test scores for the grades 4-6 subjects. Since the 19-item MDRS proved to be as reliable as the 24-item scale it can be concluded that those items concerning affective knowledge about action could be eliminated from the scale.

One very important finding in the current study is that the ratio of boys to girls was not 1:1 as reported by other researchers (Gubbay,1975; Taylor,1982; Paton, 1986). In grades 4-6 there were equal numbers of boys and girls identified by their teachers but in grades 1-3 only 9 of the children identified as physically awkward were girls and 18 were boys. Henderson and Hall (1982) directed their investigation at school children attending an "Infant School" (the equivalent of Kindergarten to grade three in Canada), and they too uncovered an unusually greater number of boys than girls (13 boys and 3 girls) who were identified as physically awkward by their teachers. Keogh, et al. (1979) found that primary teachers rated more boys than girls as physically awkward in a ratio of 3:1. It can be concluded that more boys than girls in the primary grades (1-3) have difficulties with the performance of gross motor skills.

Several recommendations can be made as a result of the findings from the current study.

Recommendations

It was shown here that the use of a rating scale does assist the teacher in focusing on specific behaviours and these rating scales are effective screening devices. It is recommended that the MDRS be used because first of all it is reliable, secondly, it divides the subjects into primary and junior students and lastly, it effectively identifies the performance of physically awkward children on gross motor skills exclusively. To be more effective, the MDRS should be shortened to 19 items for the reasons outlined above.

There was some difficulty found in the current study in analysing data gathered about children below the age of seven because not enough children were identified to make valid comparisons of the results. Motor tests designed for children in this age group do not include as many tasks as those designed for older children and the results can only be compared within the same grouping. A more extensive study should be made focusing on five and six-year-old children with a larger number of subjects. Many researchers have reported difficulties in identifying young children with movement problems (Gubbay, 1975; Sugden, 1972; Calkins, 1976; Reynard, 1976). Paul (1984) however, successfully used a rating scale to isolate physically awkward children in nursery schools (pre-primary). If identification procedures were instituted, children attending junior and senior kindergarten classes could be helped by programs of remediation right in their own school. Remediation begun at an early age might help prevent the development of a syndrome of physical awkwardness and its accompanying low self-esteem. It is recommended that further study be done with larger groups of five and six-year-old children using the MDRS as an identification instrument since it proved to be effective in the current study.

The screening procedure would be improved if different assessment instruments could be devised with gender specific items for boys and girls in grades 4-6. It is recommended that items concerning affective knowledge about action not be included in a rating scale for this age group. It is also recommended that two or three more difficult and complex motor tasks be designed to assess motor performance in physically awkward children in grades 4-6 perhaps including a task requiring the subject to strike or redirect a moving object like a volleyball, hockey puck or soccerball. Machines that propel balls from different angles such as baseballs, tennis or table tennis balls would be useful in assessing a subject's competence in reactive skills. Combining skills such as catching/trapping then dribbling and shooting with different balls might be a test that could be used to assess gross motor competence in older school children.

Finally it is recommended that further studies be done using the MDRS with the revisions recommended here for screening procedures with elementary school teachers.

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APPENDICES

APPENDIX A

Motor Performance Rating Scale

MOTOR PERFORMANCE RATING SCALE

Teacher's name____________________ Student's name______________

School___________________________ Birthdate_______ Sex ________

Age______ Grade_______

Please answer the following statement before completing this scale.

I AM CONCERNED ABOUT THE MOTOR DEVELOPMENT OF THIS CHILD.

YES NO

If you answered YES, please complete the rest of this form by circling the spot on the line (/) that illustrates the child's usual performance level.

---

1. When running this child is usually:

/____________________/____________________/____________________/

very uncoordinated	uncoordinated	coordinated	very coordinated

2. This child usually catches a ball:

/____________________/____________________/____________________/

awkwardly	with difficulty	fairly skilfully	skilfully

3. This child throws a small ball:

/____________________/____________________/____________________/

awkwardly	with difficulty	fairly skilfully	skilfully

4. This child participates in ball games:

/____________________/____________________/____________________/

rarely	sometimes	frequently	nearly always

5. This child uses playground climbing equipment;

/____________________/___________________/___________________/
rarely sometimes frequently nearly always

6. This child looks for chances to be physically active:

/____________________/__________________/____________________/
rarely sometimes frequently nearly always

7. This child seems to be:

/____________________/___________________/___________________/
very unfit unfit fit very fit

8. In balance activities this child seems to be:

/____________________/___________________/__________________/
very shaky fairly steady well balanced
unbalanced

9. This child participates in physical activity with his or her peers:

/____________________/___________________/__________________/
rarely sometimes frequently nearly always

10. This child seems to learn physical skills:

/____________________/___________________/__________________/
very slowly quite slowly fairly quickly quickly

APPENDIX B

Motor Development Rating Scale

MOTOR DEVELOPMENT RATING SCALE

Child's name_____________________________age____birthdate_______
School_______________________Teacher________________grade_____

Based on your observations of this child's competence in your physical education classes, choose the areas that he/she enjoys the most and the least.

MOST	CURRICULUM	LEAST
	GYMNASTCS	
	GAMES	
	FITNESS	
	AQUATICS	
	OUTDOOR PURSUITS	
	DANCE	
	TRACK AND FIELD	

The following items deal with basic physical skills which are required in normal play and sport development. We have tried to arrange the activities in natural skill progression, therefore when you are rating the children in your class, you may find some skills you have not observed. If so, check the column "no opportunity to observe". it is possible however, that you might have observed the child's performance of these activities in a less formal setting at recess or lunch time. Please rate as many items as possible. Each item on this rating scale gives 2 different general descriptions of children's skills or behaviour while enggaging in physical activities. To use the scale; first, choose the end of the continuum (right or left side) which is most representative of this child's usual behaviour and then, check whether you observe this behaviour, "sometimes" or "almost always". Children's behaviour is often variable but checking both sides of the scale will invalidate your observation and provide little information for remediation.

MOTOR DEVELOPMENT RATING SCALE (K-3)

A. General Impressions

THIS CHILD:

NO OPPORTUNITY TO OBSERVE	ALMOST ALWAYS	SOMETIMES				SOMETIMES	ALMOST ALWAYS	NO OPPORTUNITY TO OBSERVE
			1. looks forward to physical education classes.	OR	appears to dislike physical education classes.			
			2. enjoys physical games in group settings.	OR	avoids playing physical games in groups.			
			3. interacts easily in group activity situations in the gymnasium.	OR	seems excessively tense in group activities in the gym.			
			4. follows directions well in physical education	OR	seems confused about the teacher's instructions in the gym.			
			5. tackles physical tasks with intense effort and interest.	OR	is uninterested or easily frustrated by physical tasks.			

B. General Movement

THIS CHILD:

NO OPPORTUNITY TO OBSERVE	ALMOST ALWAYS	SOMETIMES				SOMETIMES	ALMOST ALWAYS	NO OPPORTUNITY TO OBSERVE
			1. while running, leans forward with a smooth driving action from his/her arms and legs.	OR	runs with an awkward gait.			
			2. runs fast enough to be among the first to finish a race.	OR	is usually far behind most of his or her peers in running races.			
			3. is agile at dodging in playground games like tag, etc.	OR	is easily caught in playground games.			
			4. is able to perform a rhythmic pattern of actions, like one foot hops, skips, etc.	OR	cannot maintain a series of rhythmic actions; poor timing, uneven rhythm, or stops prematurely.			
			5. uses forceful arm and knee action to gain height or distance when jumping.	OR	has little power in his or her jumps.			
			6. enjoys climbing activities.	OR	prefers action close to the floor.			

C. Gymnastics

NO OPPORTUNITY TO OBSERVE	ALMOST ALWAYS	SOMETIMES				SOMETIMES	ALMOST ALWAYS	NO OPPORTUNITY TO OBSERVE
			THIS CHILD:					
			1. is adept at using small apparatus like ropes, hoops.	OR	has difficulty using small apparatus.			
			2. is comfortable working on large apparatus; beams, box, inclined benches, etc.	OR	avoids activity on large apparatus.			
			3. is attracted to risky activities in gymnastics.	OR	avoids taking risks in the gym.			
			4. can safely absorb momentum when running, jumping, or moving about the gymnasium.	OR	is uncontrolled while running, jumping, or moving about the gym.			
			5. moves with confidence among people and objects in the gymnasium.	OR	moves cautiously and timidly among people and apparatus.			
			6. maintains a tight tuck for rolling actions.	OR	body opens up and feet, arms, or back, slap on the mat/floor.			
			7. is comfortable upside down or rightside up in gymnastics.	OR	fears being upside down for gymnastics.			

D. Games

			THIS CHILD:					
			1. can bounce a ball continuously without losing it.	OR	loses control of the ball while attempting to bounce it continuously.			
			2. can easily control a ball while moving with it (soccer, playground ball, etc.).	OR	loses control while moving with a ball.			
			3. visually tracks a ball and moves to trap/catch it.	OR	seems unable to keep his or her "eye on the ball".			
			4. reaches out to catch a flying object; ball, beanbag, etc.	OR	waits with open hands for the thrown object to arrive at his/her position.			
			5. is consistent when throwing.	OR	misses the target, goal, or partner when throwing.			
			6. can run and kick a stationary ball smoothly.	OR	loses his/her balance when kicking a stationary ball.			

MOTOR DEVELOPMENT RATING SCALE (4-6)

A. General Impressions

NO OPPORTUNITY TO OBSERVE	ALMOST ALWAYS	SOMETIMES	THIS CHILD:			SOMETIMES	ALMOST ALWAYS	NO OPPORTUNITY TO OBSERVE
			1. looks forward to physical education classes.	OR	appears to dislike physical education classes.			
			2. enjoys group games in physical activity settings.	OR	prefers to play physical games alone.			
			3. interacts easily in group activity situations.	OR	seems ill at ease with physical activity in gruops.			
			4. follows directions well in physical education.	OR	seems confused about the teacher's instructions while in the gym.			
			5. tackles physical tasks with intense interest effort.	OR	seems uninterested and easily frustrated by physical tasks.			

B. General Movement

			THIS CHILD:					
			1. while running, leans forward with a smooth driving action from his/her arms and legs.	OR	has an awkward gait when running.			
			2. performs rhythmic actions smoothly, i.e.; jumping jacks, dance steps, warm-ups.	OR	seems unable to perform a series of rhythmic movements, i.e.; has poor timing, stops prematurely.			
			3. uses strong arm and knee action to thrust him/herself into the air for jumps.	OR	uses little arm/knee action to gain power in jumping.			
			4. attains great height or distance in jumping tasks.	OR	attains poor performance scores in jumping tasks.			
			5. lands from jumps with bent knees and controlled balance.	OR	landings are heavy, unbalanced, or out of control.			
			6. can perform a series of action patterns; hops, skips, jumps.	OR	cannot perform a sequence of movements.			

C. Gymnastics

NO OPPORTUNITY TO OBSERVE	ALMOST ALWAYS	SOMETIMES	THIS CHILD:			SOMETIMES	ALMOST ALWAYS	NO OPPORTUNITY TO OBSERVE
			1. is comfortable working on large apparatus; beams, ladders, box horse, etc.	OR	avoids activity on large apparatus.			
			2. maintains a tight tuck for rolling actions; somersaults.	OR	body flattens out and feet, arms, or back, slap on the mat/floor.			
			3. safely absorbs momentum when running, jumping, or moving about the gymnasium.	OR	seldom moves forcefully enough to have trouble stopping.			
			4. is comfortable upside down or rightside up.	OR	fears being upside down.			
			5. enjoys climbing activities.	OR	prefers action close to the floor.			

D. Games

			THIS CHILD:					
			1. can easily control a ball while moving with it; dribbling, carrying.	OR	loses control of a ball while moving with it.			
			2. visually tracks a ball in order to strike it; bat, kick.	OR	seems unable to keep his/her "eye on the ball" to strike it successfully.			
			3. uses successive arm, trunk, leg, action with a follow-through when throwing.	OR	uses arm action only to throw a ball, etc.			
			4. reaches out and moves to catch a flying object, i.e.; ball, frisbee.	OR	waits for a thrown object to arrive at his or her position.			
			5. enjoys group (team) games in physical education.	OR	seems withdrawn or nervous in group games.			
			6. is involved in the main action in group (team) games in physical education.	OR	avoids the centre of action in group games.			
			7. applies a series of actions to perform plays in a game, i.e.; fielding and throwing, etc.	OR	is unable to put skills together to play a game, i.e.; run-kick-run, etc.			
			8. anticipates teammates and opponents' play, in physical games.	OR	is unaware of potential action to score or defend in games.			

APPENDIX C

GROSS MOTOR COMPETENCE TEST BATTERY

Adapted with permission from:

A Test of Motor Impairment (1972) D.H. Stott, F.A.Moyes, S.E. Henderson; The Clumsy Child (1975) S.S. Gubbay; and Canada Fitness Awards (1984) Government of Canada.

BOUNCING BALL, ONE-HAND CATCH - Description
(for five and six-year-olds)

EQUIPMENT	Tennis ball Scoring grid on record sheet
SITE	An even, hard floor surface
TASK	Subject bounces the ball on the floor and catches it on the rebound with the same hand. The ball must be caught cleanly in the hand, not trapped against body or clothing. The tester should demonstrate the proper way to catch if the subject holds his or her hand too closed or too open, does not move his or her body or arm to meet the ball, or comits some other error of technique. Success or failure should be entered on the scoring grid after each attempt.
TRIALS	Ten for each hand

Stott, Moyes and Henderson (1972)

BOUNCING, ONE-HAND CATCH _ Verbal Instructions

EQUIPMENT	Tennis ball Scoring grid on record sheet
PROCEDURE	a) Say, "Now I want you to bounce the ball on the floor with one hand and catch it with the same hand. Like this." Demonstrate the task. "When you catch the ball try not to hold it against your body or your clothing." Give two practice trials. "Now you try it." "Let's try ten of these." NOTE: The child does not have to remain stationary when retreiving the ball.
TRIALS	Ten for each hand.
SCORING	Total number of clean catches.

WALL THROW

EQUIPMENT Tennis ball
Scoring grid on record sheet

STARTING POSITION
Subject stands facing a smooth wall at a distance of 8 feet (mark with tape).

Task	Subject throw the ball to hit the wall and catches it on the return with both hands. An underarm throw must be used. The ball must be caught clear of the body, not trapped against body or clothing. The tester should demonstrate the proper way to catch if the subject holds his or her hands too closed or open, does not move his or her body or arms to meet the ball or comits some other error of technique. The tester also should show the child that the ball must be thrown high enough to give a good rebound. Success or failure should be entered on the grid after each trial.
TRIALS	10 - Do all of them.
SCORING	Score 1 for every completed task.

WALL THROW - PROCEDURE

EQUIPMENT

Tennis ball
Scoring grid on record sheet
Smooth wall and 8 foot distance marked on floor

PROCEDURE

a) Say, "Now I want you to stand behind this line and throw the ball to the wall, underhand. When the ball returns, catch it with both hands. Try not to use your body to trap the ball."

Then demonstrate and say, " It should look like this. Throw the ball to the wall and catch it with both hands. Now you try it. Good. Can you do ten?"

The tester should correct errors of technique if the subject has difficulty and indicate that the ball must be thrown high enough to give a good rebound.

TRIALS

Ten with preferred hand. Do all of them. Record after each trial. Give two practice trials.

Stott, Moyes and Henderson (1972)

CLAP AND CATCH
Gubbay, 1975

EQUIPMENT Tennis ball
Scoring grid on record sheet

PREPARATION
The starting position must be away from walls and furniture. Teacher stands in front of and to the side of the subject.

TASK Subject throws the ball into the air with preferred hand and catches the ball cleanly in two hands. The ball must not be trapped against the body or clothing. Test to three trials or to success which ever comes first in the following categories.

(Discontinue testing with three consecutive failures.)

TRIALS
a) Catch the ball with both hands.
b) Catch the ball with both hands after 1 clap.
c) Catch the ball with both hands after 2 claps.
d) Catch the ball with both hands after 3 claps.
e) Catch the ball with both hands after 4 claps.
f) Catch the ball with preferred hand after 4 claps.

Score 6 for total, add 1 if no faults = 7.

FAILURE If the ball is not caught in the prescribed manner or the clap is not visible or audible before the ball is caught.

PROCEDURE FOR CLAP AND CATCH

EQUIPMENT Tennis ball
Scoring grid on record sheet

PROCEDURE a) Say, "Now I want you to throw the ball into the air with one hand and catch it with two." Give three trials. If successful continue in this manner. "Now, throw the ball into the air with both hands." Then demonstrate and say, "It should look like this. Throw the ball up, clap and catch. Now you try it."

The tester should correct errors of technique if the subject has difficulty and indicate that the ball must be thrown high enough to allow time for the clap.

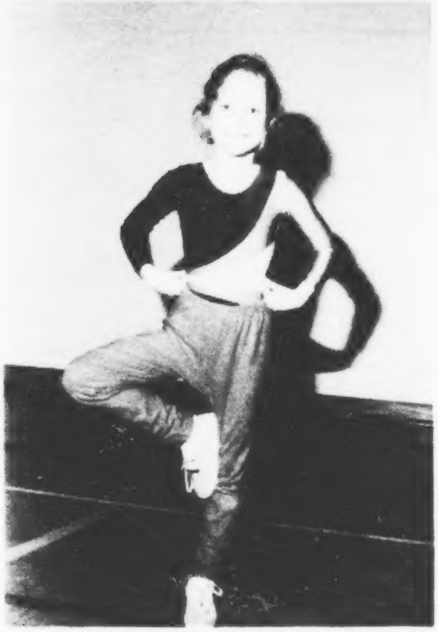
TRIALS Allow three trials or success whichever comes first. Record after each trial. If successful continue to the next condition.

FAILURE If the ball is not caught in the prescribed manner, or the clap is not visible or audible before the ball is caught.

Score is expressed in one of the folowing categories.

a) Cannot catch the ball with both hands after 0 claps.
b) Can catch the ball with both hands after 1 clap.
c) Can catch the ball with both hands after 2 claps.
d) Can catch the ball with both hands after 3 claps.
e) Can catch the ball with both hands after 4 claps.
f) Can catch the ball with both hands after 5 claps.
g) Can catch the ball with the preferred hand after 4 claps.

Maximum score = 6



STORK BALANCE
right and left

EQUIPMENT Stop watch

PREPARATION
Subject must wear running shoes.The starting position must be away from walls and furniture. Tester must stand in front of and to the side of the subject so that the feet can be observed clearly.

TASK

Subject stands on one foot and places the sole of the other foot against the side of the supporting knee. The hands are placed on the hips with the fingers facing forward.
Tester should insure that the subject is in the correct position before starting the stop watch.
The task is repeated with the other leg raised.

TRIALS

Three for each leg.

SCORING

Discontinue timing after 20 seconds.
Record time for each trial.
Stop the watch if the standing leg is moved from the original position.
Stop the watch if the free foot is moved from the inside of the knee.
Stop the watch if the hands are moved from the hips.
Stop the watch if the subject cannot adopt the balancing position and assess a score of 0.

STORK BALANCE RIGHT & LEFT - PROCEDURE

EQUIPMENT	Stop watch
PROCEDURE	Starting position must be away from all walls and furniture. Subject must wear running shoes. a) Say, "Watch me," then demonstrate the task. Stand on one foot and place the sole of the other foot against the side of the supporting knee. Place hands on hips with fingers pointing forward. b) Then stand in front of and to the side of the subject so that the feet can be observed clearly and say, "Now you try it. Let's see how long you can do it. Now do it with the other foot." Tester should insure that the correct position is attained before starting the stop watch.
TRIALS	Give three for each leg.
FAILURE	Standing leg is moved from the original position. Free foot is moved from the inside of the knee. Hands are moved form the hips. Subject cannot adopt the balancing position.
SCORING	Average number of seconds from three trials.

Stott, Moyes and Henderson (1973)

HIGH JUMP
(for children under 84 months of age)

EQUIPMENT

Set of jumping standards
Two 3-inch long wooden dowells
Weighted cord

PREPARATIO

Tester measures subject's knee height - from the floor to the lower border of the kneecap. Place the cord on the pins at that height and mark #3. The pins should be on the far side of the child as he or she jumps to allow the cord to fall off without overturning the stand.
Calculate half the distance and mark #2. Place string on floor between standards (#1).

The jumping stands should be rather more than shoulder width apart.

TASK

From a stationary position with two feet together the subject jumps over the cord.

The feet must be together for take-off and landing.

A timid child may be helped over a few times to overcome fear of jumping. These must not be counted as trials.

TRIALS

a) Jump over cord at height #1 (cord on the floor)
b) Jump over cord at height #2 (1/2 knee height)
c) Jump over cord at height #3 (Knee height)

FAILURE

If the subject displaces the string.
The feet are not kept together during take-off and landing.
Knock over the stand.
If subject cannot jump over the cord.

Procedure for High Jump

EQUIPMENT

Set of jumping standards
Two three-inch dowells (pins)
Weighted cord

PROCEDURE

Measure subject's knee height from the floor to the lower edge of the kneecap. Place cord on pins at this height. This is height #3. Divide by two and mark this height as #2. Standards should be slightly more than shoulder width apart. Pins face the direction of the jump. Begin trials with cord on the floor (height #1).

a) Say, "Now stand with your feet together and jump over the cord. Land on both feet". Demonstrate the task. "Now, you try it".

TRIALS

Allow three trials or success, which ever comes first.
Record after each trial. If successful continue to next condition. If unsuccessful on three trials of any condition, discontinue testing.

SCORING

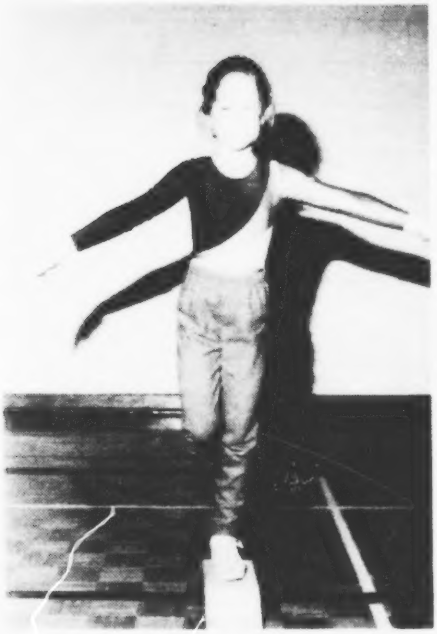
Score is expressed as a total out of nine.

Record a minus (-) for missed trials, a plus (+) for successful trials. Total the +'s and blanks for a score out of 9.
Example:

: floor :	: 1/2 knee :	: knee :
-	-	-
+	-	-
	+	-

EXAMPLE SCORE = 3

Stott, Moyes and Henderson (1972)



WIDE BOARD BALANCE
right and left

EQUIPMENT Stop watch
One balance board
Subject must be wearing running shoes

PREPARATION
The balancing board should be placed with the keel on the underside away from walls and furniture. Tester must stand in front of and to the side of the subject so that the feet can be clearly observed

TASK	Subject balances on the board on one leg. Tester may advise the subject to place his or her foot firmly on the middle of the board and then raise his or her other foot gently. Tester should ensure that the subject is in the correct position before starting the stop watch.
TRIALS	Three for each foot.
SCORING	Discontinue timing after 10 seconds. Record time after each trial. Stop watch : If the standing leg is moved from the board. If the board tilts so that the sides of the board touch the floor. If the free leg touches the floor. If the subject cannot adopt the balancing position then assess a score of 0.

WIDE BOARD BALANCE RIGHT & LEFT - PROCEDURE

EQUIPMENT

Stop watch
One balance board

PROCEDURE

Place the balance board with the keel on the underside on the floor away from walls and furniture.

a) Say, "Place one foot on the middle of the board. Now raise your other foot gently off the floor. Good." Or "Like this. Now let's see how long you can do it. Good. Now, place your other foot on the board."

Tester should ensure that the subject is in the correct position before starting the stop watch.

TRIALS

Give three for each leg.

FAILURE

Standing leg is moved from the board.

Free leg touches the floor.

Subject cannot adopt the balancing position.

If the board tilts so that the sides of the board touch the floor.

SCORING

Average of three trials.

Stott, Moyes and Henderson (1972)

CONTROLLED JUMP
right and left

EQUIPMENT Set of jumping standards
Weighted cord
Stop watch

PREPARATION Tester measures subject's knee height from the floor to the lower edge of the knee-cap and places the cord on the pins at the same height.

The pins should be on the far side of the child as he or she jumps to allow the cord to fall off without upsetting the stands. The jumping stands should be rather more than shoulder width apart.

TASK Subject takes off with the feet together, jumps over the cord and lands on one foot. Subject must remain on the landing foot for 5 seconds - without the other foot touching the floor. (A minor adjustment of the landing foot is permitted).
Both feet are tested.
The stop watch is started when the subject lands.

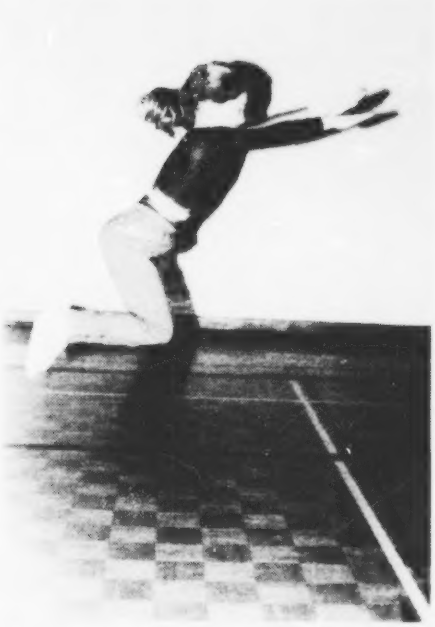
TRIALS Give three for each leg.
Record the time after each trial.

SCORING Assess failure and assess time of 0:
If the subject does not take off from both feet.
If subject does not land on one foot and maintain the position for 5 seconds.
If subject displaces the cord.

CONTROLLED JUMP RIGHT AND LEFT - PROCEDURE

EQUIPMENT	Set of jumping standards Weighted cord Stop watch
PROCEDURE	Measure subject's knee height from the floor to the lower border of the kneecap. Place cord on pins at this height. Standards should be slightly more than shoulder width apart. Pins face direction of jump. Say, "First we will measure your leg. Now stand with your feet tegether, jump over the cord and land on your right (preferred) foot. When you land keep your position as long as you can." Start the stop watch when the subject lands.
TRIALS	Three trials for each leg.
FAILURE	Subject does not take off with 2 feet together. Cord is displaced. Subject does not land on one foot and keep position for 5 seconds. NOTE: A minor adjustment of the landing foot is allowed.
SCORING	Average time of three trials.

Stott, Moyes and Henderson (1972)



STANDING LONGJUMP
Canada Fitness (1984)

EQUIPMENT
A 3-metre hard surface
Gymnastic mat
A tape measure

START
The subject stands with the feet slightly apart and the toes behind the takeoff line.

PERFORMANCE The hips and ankles should be bent enough so that the subject can vigorously push with his or her legs and swing with his or her arms to assist in performing as well as possible.The subject should be encouraged to make the down, up and forward drive as continuous as possible.

SCORING Measurement is in centimetres to the nearest cm from the takeoff line. A metre stick should be placed behind the nearest heel extending perpendicularly across the measuring tape.

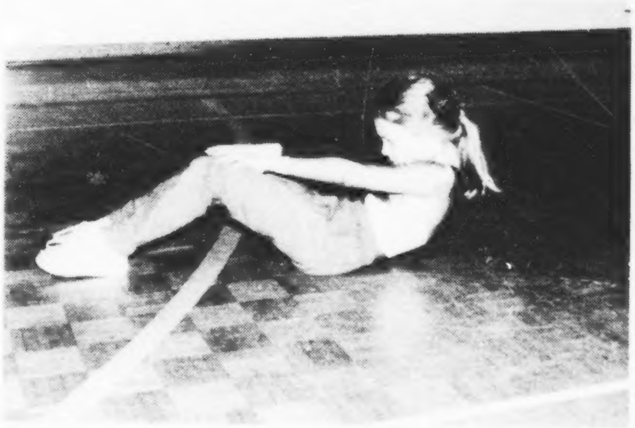
CONTROL The suggested takeoff angle should be between 30 qnd 45 degrees. A tester demonstration is necessary. Two valid trials are allowed, the better trial recorded. The subject should be made aware of the recorded measurement for the first trial, If any part od the body touches behind the heels, the jump will be invalid. Subjects should not be required two measured trials in succession. A rotation through the participants is suggested. The starting line is located on the mat. The measuring tape should be located off centre on the right of the mat.

THE SHUTTLE RUN

EQUIPMENT	Three wooden blocks (5 cm x 7.6 cm x 7.6 cm) and a stopwatch calibrated to 1/10th of a second. One block is placed beside the subject on the starting line and two blocks placed on the line 10 m away. The space allotted to the shuttle run should allow adequate running area beyond the first line.
START	The subject lies face down, hands at the sides of the chest (palms on the floor) and the forehead on the starting line.
PERFORMANCE	On the signal, the subject jumps to his or her feet and runs 10 metres to the line, picks up one block, and returns to the start line. The subject sets down the block he or she is carrying across the line, picks up another block and returns to the line 10 m away where he/she exchanges the block he/she is carrying for another and then runs back across finsh (starting) line.
SCORING	Measurement is in seconds to the nearest tenth of a second from the starting signal until the subject's chest crosses the finish line.
CONTROLS	The test should be taken in gym shoes or bare feet. A "ready" warning signal is given prior to the starting signal. Two trials with sufficient rest in between are allowed and the better trial is recorded. When demonstrating indicate that rapid movement of the feet to stop and start in a new direction is most efficient.

Canada Fitness Awards (1984)

PARTIAL CURLUPS



EQUIPMENT
Gymnastic mat, metronome
(set to 40 per min.)

STARTING POSITION
The subject lies on back, knees slightly bent at an angle of 140 degrees (6 - 10 cm 0ff the floor), heels on the floor, arms extended along the thighs with fingers pointed towards the knees.

STABILIZATION, HOOKING OR ANCHORING THE FEET IS NOT PERMITTED.

ACTION The initial phase of the curlup must involve a flattening out of the lower back region(i.e., pelvic tilting), followed by a slow "curling up" of the upper spine sliding the hands along the thighs until finger tips touch knees. At this point, the trunk should be raised at an angle no greater than 30 degrees to the floor. Heels must remain in contact with the floor at all times. Return to starting position touching the tester's hand with back of head. The movement is slow and well controlled. The time taken to perform the lifting and lowering stages is the same. The cadence is 20 curlups per minute or 3 seconds per movement. Verify the metronome with the stopwatch. The subject should perform without pausing between curlups to a maximum number with-out a time limit. Allow the participant to practise the exercise several times prior to testing.

PARTIAL CURLUPS

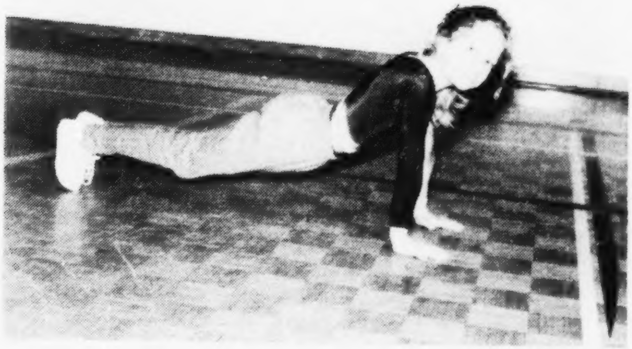
The test is terminated if the subject:

a) appears to be experiencing severe discomfort;
b) is unable to maintain the correct rhythm and must rest (stop test after subject falls behind more than 3 repetitions);
c) consistenly displays poor technique* despite repeated corrections by the tester (a maximum of 3 corrections may be tolerated

* Examples of poor technique:

- lifting the heels off the floor;
- failure to slide hands along thighs (i.e.; throwing hands forward is not allowed);
- head not touching the tester's hand;
- failure to maintain desired angles at knees trunk.

Canada Fitness Awards (1984)



PUSHUPS

EQUIPMENT Hard surface gym mat

STARTING POSITION Subject assumes a front lying position with the hands placed approximatelyunder the shoulders, legs are straight and together and toes tucked under so that they are in contact with the mat.

ACTION The subject pushes with the arms until they are fully extended keeping the legs and back straight.
The body is then lowered using the arms, bending the elbows and keeping the back in a straight line from the head to toes until the the elbows reach 90 degrees and the upper arms are parallel to the floor. This movement is repeated as many times as possible. There is no time limit on this test but pushups must be performed rhythmically and continuously.

The test is terminated for the following reasons:

a) Participant seems to be experiencing extreme dicomfort or pain;
b) Subject is unable to maintain a rhythmic motion and must rest (stop test after subject falls behind more than 3 repetitions);
c) Subject consistently displays poor technique* despite repeated corrections (a maximum of 3 corrections may be tolerated).

* Examples of poor technique:
- knees touching the mat;
- upper or lower back swaying;
- failure to reach a complete arm extension;
- failure to attain an approximate 90 degree bend of the elbows

The tester should demonstrate the correct movement and most common faults. Participants should be allowed to practise. Remember that too many practice trials before testing will fatigue the children.

Have the subjects work in partners to test what a 90 degree angle at the elbows feels like.

Remind the subjects to breathe normally and not hold their breath while performing pushups.

SCORING Count the total number performed

Canada Fitness Awards (1984)

APPENDIX D

Manual for Researchers

University of Alberta
Edmonton

Canada T6G 2H9

Department of Physical Education and Sport Studies

P-421 Universiade Pavilion
Van Vliet Physical Education and Recreation Centre

April 24, 1986

Dear Parents,

During the past year the University of Alberta, in cooperation with the Edmonton Public School Board, has been developing programs to help less-skilled children enjoy the benefits of physical education. While most young children enjoy physical activity and need no urging to participate, many tend to avoid it because of unfavourable encounters in sport and play activities with their peers.

Over the past six years, the Motor Development Clinic at the University of Alberta has developed program material and teaching strategies to help alleviate the physical coordination difficulties experienced by some children. However, the staff at the Clinic believes that children with less severe coordination difficulties can be helped more effectively in school-based programs; hence, we are developing new programs to meet the needs of such children within their own community.

As part of our program development work, we intend to measure the fitness and motor performance of children in grades kindergarten through five in a number of Edmonton Public School Board schools during the next few weeks. Some of the children we will be testing may have physical coordination difficulties while others will be quite skillful. However, gathering information on the performance levels of a broad range of children will help us identify those children who might benefit from our program.

Since the goals of physical education include the promotion of positive experiences in the physical domain, the assessment procedures we plan will be made as pleasant and rewarding as possible for the children who take part.

If you will allow your child to be included in the initial assessment phase of the project, please sign the attached Consent Form and return it to your child's school. All assessment results will be communicated to the parents of children involved in the project. These reports will outline the fitness and skill strengths and weaknesses of individual children. Materials on how you can help your child enjoy participating in physical activity will be included in the report.

We will contact you again if your child would benefit from the remedial phase of this project which should begin in the fall of 1986.

...2

Thank you very much for taking the time to read this material. I hope you will allow your child to participate in our project.

Sincerely,

A. E. Wall, Ph.D.
Professor and Chairman.

Encl.

AEW/sb

CONSENT FORM

I, ____, grant

permission for ______________________________,

age ____________, to be involved in two half-hour motor

performance testing sessions.

____

Signature of Parent or Guardian

TESTING PROTOCOL

TWO EXAMINERS...FOUR CHILDREN

Teach push-ups and curl-ups to all four children.

Begin with two children; let the other two pracitise.

When you are doing the shuttle run, one examiner should observe and assess the level of running style; initial (1), elementary (2), or mature (3).

For other tests each examiner tests one child each.

Intersperse the balance items with more active items.

Finish with curl-ups and push-ups.

Be accurate on handedness. Do have them write their names.

If a child is in one month of their birthday, do the next-aged test as well.
(This is important with five and six-year-olds).

Be sure to make it fun.

name ____________________

SCHOOL ____________________ GRADE __________

NAME ____________________ (written by child)

AGE __________ BIRTHDATE ____________________

SEX __________ PREFERRED HAND ____________________

EXAMINER ____________________ DATE __________

BALL SKILLS		scores										percentile
(5-yr-old) 2-hand bounce and catch												
(6-yr-old) 1-hand bounce and catch	P											
	NP											
(7-12) wall throw (10)												
(7-12) clap & catch (3)		-	1	2	3	4	4D					
COMMENTS												

BALANCE		scores	percentile
(5-yr-old) toe balance (10 sec)			
(6-yr-old) 1-leg balance (15 sec)			
(7-12) stork balance (20 sec)	R		
	L		
(7-12) wide board balance (10)	R		
	L		
COMMENTS			

LOWER LIMB COORDINATION	scores				percentile
(5-yr-old) hopping (15 ft)	R				
	L				
(6-yr-old) high jump (3 trials)					
(7-yr-old) controlled jump(1 sec)	R				
	L				
(8-12) controlled jump (5 sec)	R				
	L				
COMMENTS					

FITNESS (CANADA)	scores		average	percentile
long jump (2 trials, averaged)				
COMMENTS; level 1 2 3				
SHUTTLE RUN (2 trials, averaged)				
COMMENTS; level 1 2 3		special characteristics		
curl-ups (continuous total)				
COMMENTS				
push-ups (continuous total)				
COMMENTS				

Illustration: The developmental sequence of the standing longjump (from McClenaghan, B., and Gallahue, D., Fundamental Movement: A Developmental and Remedial Approach. Philadelphia: W.B.Saunders Co., 1976).

Illustration: The Developmental sequence of throwing (Wickstrom, R.L., Fundamental Motor Patterns, 2nd Edition, 1977. Philadelphia: Lea & Farbinger. Redrawn from Wild, N., Research Q., American Association of Health Physical Education, 1938).

APPENDIX E

Pilot Study: Identifying and remediating physically awkward schoolchildren, a program development project.

Weir, J. (1986). Unpublished paper, University of Alberta, Edmonton.

PILOT STUDY: A PROGRAM DEVELOPMENT PROJECT

Introduction

Based on the Motor Develpment Clinic at the University of Alberta, a program development project was initiated in cooperating elementary public schools in the Edmonton Public School Board in 1985/86. The Motor Development Clinic had provided assessment and counselling services for physically awkward children over the course of the previous five years. Individual instruction programs were implemented at the clinic for approximately 50 children during that time. The Pilot Study was conceived as a project to extend the positive results achieved in the Motor Development Clinic into neighbourhood schools. The Edmonton Public School Board agreed to introduce a Program Development Project as proposed by Wall in 1985 at four elementary schools in the community.

This account of the pilot study will explain how rating scales were used by regular teachers in a screening procedure to identify physically awkward children within their physical education classes. Motor tests were administered to the children identified by their teachers to establish each child's level of motor performance and to validate the need for remediation. Identification was followed by the development of a remedial program offered within the children's home schools and aimed at alleviating the problems physically awkward children might encounter.

The Program Development Project was a three-phase project implemented over a 12 month period of time. The multi-assessment approach which had proved successful at the Motor Development Clinic was adopted for the project. Phase I of the project included an initial screening by the teachers in which they completed a ten-item Motor Performance Rating Scale to identify children with movement difficulties. This quick screening procedure was followed by the completion of a 40-item Motor Development Rating Scale adapted from Umansky (1983) and Clifford (1985). This longer scale was used with the intent of gaining more pertinent information about children's gross motor skills in order to devise individual instruction programs for children considered motorically at risk. In phase II a Leisure Pursuits Checklist (Taylor and Clifford, 1985) was answered by the parents of each child involved in the project providing a more complete picture of individual motor performance and the activity preferences of each child. Phase III commenced in the fall of the year at which time instructors were assigned to each of the four schools. Individual programs of physical activity were developed by the instructors to suit each child identified as being physically awkward. Evaluation of each child's progress was done on a weekly basis and ongoing leisure counselling with students and parents was continued throughout the duration of the project from October, 1985 until May, 1986. The varying needs presented by the children were addressed on an individual basis but group sessions were also included in the physical education instruction offered to the children with motor problems.

METHOD

Sample

The sample for this project was drawn from four elementary schools on the south side of the city. Although all of the schools were located in the same area of Edmonton each had different atmospheres and special program emphases. The teachers who taught physical education were asked to complete the rating scales for their students. Only a few of the classroom teachers taught physical education to their own students. In one school the principal taught all of the physical education classes and he placed a high priority on physical fitness. All of the teachers would have observed the students on the school playgrounds because the staffs in each school take turns supervising outdoor play before and after school as well as at recess time. The total population of the four schools was 558 students, 324 of whom were in the primary grades (Kindergarten to grade three).

Procedure

The late spring was chosen as a good time of year for Phase I, the screening procedure, because the teachers would have had eight or nine months in which to observe their pupils in physical education classes and on the playground. In the first step of Phase I the researchers met with the staffs in each school, explained the proposed program and described the typical behaviours manifested in a syndrome of physical awkwardness. Teachers were quite willing to identify children in need of help if there was to be a remedial program in place and if the negative aspects of labelling could be avoided. While teachers of physical education were able to immediately produce some examples of children in their classes who might benefit from a remedial program, they preferred to have some time to review and focus on the motor behaviour of their students with the help of a list of specific physical skills, such as those found on the Motor Perfromance Rating Scale, to confirm their opinions. The Motor Performance Rating Scale had ten items about gross motor activities such as running, throwing, catching and balancing but the first question on the scale was "I am concerned about the motor development of this child. YES or NO." If the teachers of physical education answered "Yes", then they completed the rest of the scale. The teachers rated their students using a four-point scale on each of the ten items. The ten items on the scale required the teachers to rate the skillfulness of the students in their physical education classes by comparing them with their classmates when they run, balance, catch a ball, and climb on playground equipment. Teachers were asked to note the frequency with which their students took part in physical activities with their peers, or played ball games. The scale asked teachers to decide whether each child seemed fit and if he or she avoided physical education classes.

In the second step of Phase I of the Pilot Study a revision of the Umansky-Clifford Motor Development Rating Scale was completed by the teachers. Using this scale the teachers rated the motor performance of the children they identified in the first step of Phase I. There were forty items on this rating scale. The scale was developed originally by Umansky in1983 who selected items that were strictly motor activities requiring little or no inference from the observer. The items chosen by Umansky were validated by nine professionals to determine the clarity and age-appropriateness of each item. Two checklists were used for two age groups of children but they were later combined by Clifford (1985) to eliminate a ceiling effect. Clifford changed the order of items on the rating scale by listing the motor skills in progressive order. As an example of the learning progression of skills utilized by Clifford (1985); catching skills are listed from, "catching a 20 centimetre ball with two hands, to catching a ball thrown to the right or left of the catcher, to catching a ball with a glove, to playing a good positional game of softball".

Other problems arose concerning the use of Umansky's rating scale. First, many teachers had difficulty understanding the prediction factor of the scale in which they were asked to predict how their pupils might perform certain skills even though they had not observed the child attempting those activities (Clifford, 1985). Secondly, many teachers were hesitant to rate children on skills that were not part of the curriculum (Clifford, 1985). Predictions are not much better than guesses (Cronbach, 1970; Guildford, 1967) in any case, so the instructions for completing the rating scale in the pilot study did not require the teachers to make predictions about activities they had not observed.

The above rating scales were revised further for the Program Development Project to include additional items listing skills in order of learning progression in the areas of dance, gymnastics, and soccer activities that are on the elementary school physical education curriculum (Alberta Department of Education, 1983). Complex skills require more cognitive input from the participant than simple or reactive skills and complex skills cannot be easily measured with motor assessment procedures. Motor test batteries usually assess discrete motor skills that require very little metacognitive knowledge about action. On the other hand, teachers can observe their students performing complex skills regularly in physical education classes. The performance levels teachers observe in their students should reflect the metacognitive knowledge required for skilled behaviour, therefore, the ratings of the teachers concerning levels of skilled behaviour are critical in an identification procedure.

In order to eliminate the prediction factor in this pilot study, teachers were instructed to leave ratings blank if they had not observed a student performing specific skills listed on the rating scales. It was hoped that there would be few blanks because the items chosen concerned activities listed in the curriculum guide (Alberta Education, 1983).

Information about motor confidence while performing prescribed physical activities should emerge from a scale that follows the curriculum. Motor confidence however, can be altered by social pressures while participating in group games and teachers are in a position to observe their students' behaviour in this situation.

Another revision of the Motor Development Rating Scale used in this Pilot Study (1986) was to change the rating categories. New categories were derived from the prompting continuum that had proven successful as a teaching strategy in the Prep Program (Watkinson & Wall, 1982) at the University of Alberta. The wording of the revised ratings allowed the teachers to rate their students over four levels of motor behaviour in a continuum from unskilled to skilled for each of the items on the scale. The categories used were: "with physical assistance, with verbal assistance, independently, skillfully". These four categories are oriented toward teaching techniques and qualities of performance rather than toward a quantitative rating of skilled performance.

In Phase II of the Program Development Project a battery of motor tests was administered to the children who were identified as being potentially physically awkward in order to validate the screening procedure. The motor tasks chosen were adapted from Taylor (1982). Taylor's battery of motor tests, which were in turn adapted from Gubbay (1975) and Stott, Moyes and Henderson (1972), had been validated on a large sample of Edmonton Public School children. In addition, four Canada Fitness Awards tests (1984) were used to assess the children's motor performance based on the notion that physically awkward children would be less fit than their more adept peers (Wall & Taylor, !984; Paton, 1986). The battery of tests included two items that assessed ball skills, two balance tasks, a controlled jump, a long jump, an agility run, curlups, and pushups, totalling 12 sub-tests in all. If a child scored below the tenth percentile as established by the Canada Fitness Awards norms (1984) or the norms from Taylor's battery of motor tests, then that child's profile was examined to determine whether several other scores were on the lower end of the scale and in what areas of performance he or she seemed to have difficulties. The selection of physically awkward children was post-hoc and not based on a specific coding rule. Four motor performance and fitness scores at or below the tenth percentile was used as a guideline, but if a child had a generally low performance or if all the test results were below the twenty-fifth percentile with perhaps only two below the tenth percentile, than that child was categorized as physically awkward. During this evaluation process note was taken of the qualitative assessment done by the research team, such as a judgment of the level of maturity exhibited in running and jumping skills as outlined by McLennaghan and Gallahue (1982), to help in gaining an overall profile of each child's skill performance. Professional judgment was used in each case and thus flexible criteria were applied to the skill profiles of individuals. Individual programs were designed for each child based on the evaluation.

As part of the evaluation procedure written reports summarizing the areas of strength and weakness displayed by each child were delivered to parents and teachers. Suitable leisure activities were suggested and community resources outlined for parents. It was also hoped that these reports would promote sensitive treatment at school and that teachers could adjust physical education programs for those children who needed extra practice time and/or more specific instruction in the required physical education program.

Results

A total of 83 children, 41 girls and 42 boys, were identified by their teachers as being possibly physical awkward. The parents of 55 of these children granted permission for them to take part in Phase II of the project.

The rating scale asked the teachers to rate the children about whose motor development they were concerned on a continuum extending over four points. A simple likert scale was used to evaluate the ratings that teachers gave to their students. Two of the points on the continuum were deemed to be on the awkward end of the scale and the other two were classified as being on the skillful end of the continuum. By assigning values of one and two to the lower (awkward) end of the scale, and a value of three and four to the categories at the higher (skillful) end, a score could be computed for the performance levels of the children rated with this scale. On this basis, a score of 40 would be considered skillful while a score below 20 would indicate severe awkwardness. The results of this rating scale were validated by fitness and motor performance tests completed by 55 children whose teachers had judged them as physically awkward. Only two of the children whom teachers had designated as awkward were found to have few motor problems as assessed by the motor tasks (Weir, 1986).

Each child's profile was examined individually in order to make reports to parents and to teachers for follow-up projects or programs. In this case, the qualitative observations made by each member of the research team were consulted as well as overall scores in order to present a written evaluation to parents and teachers. A student might perform poorly in one domain and be quite proficient in others (Wall, 1986); for example, some children might benefit from help in the development of ball skills only. Some movement difficulties can be dealt with through counselling rather than with extra practice time; for instance, if a child was adept at ball skills yet inadequate in balance tasks he or she should be encouraged to practise tennis, baseball, or soccer and to avoid competitive participation in skate boarding, water skiing, or snow boarding. Some children require more practice time than others just to reach adequate levels of performance and perhaps the wisest course for some is to increase self-esteem by becoming very good at the activities in which a degree of aptitude is already established.

Subsequent examination of the MPRS showed that teachers had difficulties with the four-point likert scale that was used and they questioned the validity of some of the items listed in it. Specifically, seven of the items were found to be good discriminators of awkward behaviours when follow-up motor tests were completed (Weir, 1986) due to the agreement between performance and teacher observation. One item on the screening scale asked about the frequency with which children avoided participation in physical education classes and the majority of teachers indicated that their students did not avoid participation. One of the pitfalls of rating scales that Cronbach (1970) mentions is that items perceived as a reflection on teaching ability or classroom management will not be answered objectively. It appeared that teachers did not rate their students' behaviour objectively on this item. Teachers do not seem to recognize the "invisible player" identified by Griffen (1985) who masks his or her incompetence by avoiding participation in physical activity while at the same time giving the appearance of being involved in games. For this reason the item concerning avoidance of physical education was dropped from the revised scale used in the present study. A similar item was added to the longer scale in the present study however, asking if the child liked physical education. This item was included in an attempt to confirm the notion that a negative affective knowledge base would be acquired by children who have difficulty with gross motor skills.

Another problem identified in this pilot project was that the items on the scale were too specific. Many teachers felt that they could not rate their students on every specific item since both time and interest limit the number of activities from the curriculum that are covered. Unobserved activities continued to plague the results and analysis of data. Only 33 observations were recorded on dance out of a possible 220. It was recommended that items dealingwith curricular activities be included in future rating scales.

An additional problem with the rating scales was created in the pilot study because the teachers had a great deal of difficulty with the rating categories which may have been due to the fact that they were unfamiliar with task analysis in the area of physical education. It was recommended that frequency ratings be used in gathering observational data in the future.

The results in this pilot study influenced the design for the current study and the recommendations were considered when developing the rating scales that teachers can use to identify physically awkward schoolchildren.

Summary

The purposes of the Program Development Project were two-fold in that a method of screening physically awkward children was being sought and a remedial program was being initiated. The rating scales were evaluated in light of the follow-up program that was developed in each school. The rating scales as validated by the motor test battery indicated that the teachers were very perceptive about the motor problems of their students. Teachers completed rating scales for only those children about whose motor development they were concerned and 53 of the 55 children thus identified were indeed children who scored low on the motor tests and benefitted from follow-up remedial programs. Further information was gathered about each child involved in the project through interviews with both teachers and parents about the interests and leisure activities of the participants. The total picture thus gained seemed to confirm that teachers correctly rated children with motor problems with the use of a rating scale.

Written reports were delivered to the parents and teachers of each child involved immediately after the screening procedure and this communication continued throughout the school year with assessment and progress reports in addition to student and parent counselling about leisure activities. The students who were recommended for participation in the Program Development Project made gains in skill improvement and seemed to gain in confidence as well. The parents and teachers expressed their pleasure and were grateful for the positive help the students received.

The Program Development Project made several recommendations concerning the effectiveness of the rating scales which helped determine the design of the scales for future studies.

APPENDIX F

Analysis of Variance on each motor test,
grades 1-3 PA (n = 27) NA (n = 27) .

Appendix F. Analysis of variance on each motor test, grades 1-3 PA (n=27) & NA (n=27).

1. Wall Throw

Source	Sums of Squares	df	Mean Square	F- Ratio	P < .05
Group	79.21	1	79.21	10.59	.002**
Sex	0.54	1	0.54	0.072	0.789
Interactions	2.21	1	2.21	0.296	0.589
Error	373.95	50	7.48		

2. Clap & catch

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	27.19	1	27.19	11.35	.001***
Sex	0.09	1	0.09	0.04	0.844
Interactions	1.22	1	0.22	0.09	0.762
Error	119.84	50	2.39		

3. Stork balance , right foot

Source	Sums of Squares	df	Mean square	F-Ratio	P < .05
Group	305.69	1	305.69	14.07	.0001****
Sex	18.51	1	18.51	0.85	0.361
Interactions	3.82	1	3.82	0.18	0.677
Error	1084.52	50	21.69		

4. Stork balance, left foot

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	201.45	1	201.45	8.39	.006**
Sex	29.77	1	29.77	1.24	0.271
Interactions	3.31	1	3.31	0.14	0.712
Error	1199.93	50	23.99		

5. Wide board balance, right foot

Source	Sums of squares	df	Mean Square	F-Ratio	P < .05
Group	47.07	1	47.07	6.54	.014*
Sex	2.06	1	2.06	0.28	0.596
Interactions	1.64	1	1.64	0.23	0.636
Error	360.13	50	7.21		

6. Wide board balance, left foot

Source	Sums of squares	df	Mean Square	F-Ratio	P < .05
Group	24.65	1	24.65	3.23	0.078
Sex	0.96	1	0.96	0.126	0.724
Interactions	6.26	1	6.26	0.82	0.371
Error	381.92	50	7.64		

table continues

Appendix F. continued.

7. High jump, Preferred foot

Source	Sums of Squares	df	Mean Square	F-Ratio	P <.05
Group	65.07	1	65.07	26.56	.0001****
Sex	2.48	1	2.48	1.01	0.319
Interaction	1.56	1	1.56	0.64	0.429
Error	122.49	50	2.45		

8. High jump, Non-preferred foot

Source	Sums of squares	df	Mean Squares	F-Ratio	P < .05
Group	68.58	1	68.58	28.41	.0001****
Sex	7.38	1	7.38	3.06	0.086
Interaction	1.02	1	1.02	0.672	0.518
Error	120.71	50	2.41		

9. Long jump

Source	Sums of Squares	df	Mean Squares	F-Ratio	P < .05
Group	6105.03	1	6105.03	16.83	.001***
Sex	3721.82	1	3721.82	10.26	.002**
Interaction	456.33	1	456.33	0.23	0.267
Error	18141.72	50	362.83		

10.Shuttle Run

Source	Sums of squares	df	Mean Squares	F-Ratio	P < .05
Group	80.08	1	80.08	28.93	.0001****
Sex	4.73	1	4.73	1.71	0.197
Interaction	0.03	1	0.03	0.01	0.917
Error	138.39	50	2.77		

11.Curlups

Source	Sums of Squares	df	Mean Squares	F-Ratio	p < .05
Group	528.89	1	528.89	9.22	.004**
Sex	26.01	1	26.01	0.45	0.504
Interaction	126.75	1	126.75	2.21	0.144
Error	2869.61	50	57.39		

12. Pushups

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	156.48	1	156.48	11.42	.001***
Sex	0.926	1	0.926	0.07	0.796
Interaction	50.71	1	50.71	3.71	0.061
Error	684.89	50	13.69		

end of table

Appendix G

Analysis of variance on each motor test, grades 4-6 PA (n = 31) NA (n = 31).

Appendix G. Analysis of variance on each motor test, grade 4-6 NA (n=31) & PA (n=31).

1.Wall throw

Source	Sums of Squares	df	Mean Squares	F-Ratio	P < .05
Group	82.62	1	82.62	11.94	.001***
Sex	7.62	1	7.62	1.01	0.298
Interactions	4.29	1	4.29	0.62	0.434
Error	401.48	58	6.92		

2. Clap & catch

Source	Sums of Squares	df	Mean squares	F-Ratio	P < .05
Group	17.91	1	17.91	11.73	.001***
Sex	0.23	1	0.23	0.151	0.699
Interactions	1.08	1	1.08	0.711	0.403
Error	88.55	58	1.53		

3. Stork stand, right foot

Source	Sums of Squares	df	Mean Squares	F-Ratio	P < .05
Group	47.89	1	47.89	3.12	0.821
Sex	46.19	1	46.19	3.01	0.088
Interactions	1.59	1	1.59	0.11	0.748
Error	886.99	58	15.29		

4. Stork stand, left foot

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	29.19	1	29.1`9	1.91	0.173
Sex	43.67	1	43.67	2.85	0.097
Interaction	0.069	1	0.069	0.005	0.947
Error	889.16	58	15.33		

5. Wide board balance, right foot

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	32.39	1	32.39	5.83	.021*
Sex	48.21	1	48.21	8.38	.005**
Interactions	3.37	1	3.37	1.02	0.447
Error	333.63	58	5.75		

6. Wide board balance, left foot

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	26.08	1	26.08	4.41	.040*
Sex	58.67	1	58.67	9.91	.003**
Interactions	0.362	2	0.362	0.18	0.67
Error	343.75	58	5.93		

Table continues

Appendix G. continued.

7. Controlled jump preferred foot

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	49.56	1	49.56	20.94	.0001****
Sex	7.57	1	7.57	3.21	0.079
Interactions	2.09	1	2.09	0.887	0.351
Error	137.28	58	2.37		

8. Controlled jump, non-pref. foot

Source	Sums of Squares	df	Mean Squares	F-Ratio	P < .05
Group	33.23	1	33.23	13.83	.0001****
Sex	5.34	1	5.34	2.22	0.142
Interactions	0.58	1	0.58	0.242	0.625
Error	139.34	58	2.41		

9. Long jump

Source	Sums of Squares	df	Mean Squares	F-Ratio	P < .05
Group	5724.22	1	5724.22	15.85	.0001****
Sex	972.61	1	972.61	2.69	0.106
Interactions	396.72	1	396.72	0.09	0.299
Error	20947.37	58	361.16		

10. Shuttle run

Source	Sums of Squares	df	Mean Squares	F-Ratio	P < .05
Group	87.25	1	87.25	58.76	.0001****
Sex	1.98	1	1.98	1.34	0.252
Interactions	0.05	1	0.05	0.04	0.851
Error	86.12	58	1.49		

11.Curlups

Source	Sums of Squares	df	Mean Squares	F-Ratio	P < .05
Group	1563.25	1	1563.25	4.41	.024*
Sex	516.77	1	516.77	1.79	0.187
Interactions	4.11	1	4.11	0.02	0.906
Error	16786.42	58	289.42		

12.Pushups

Source	Sums of Squares	df	Mean Square	F-Ratio	P < .05
Group	956.48	1	956.48	18.88	.0001****
Sex	33.42	1	33.42	0.66	0.421
Interactions	52.37	1	52.37	1.03	0.313
Error	2937.46	58	50.65		

end of table

APPENDIX H

Part 1. Analysis of variance 2 (group) x 2 (sex) on each item of the MPRS, grades 1-3.

Part 2. Analysis of variance 2 (group) x 2 (sex) on each item of the MPRS, grades 4-6.

Appendix H, Part 1. Analysis of variance 2 (group) x 2 (sex) on each item of the MPRS, grades 1- 3.

Item #1. running n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P < .05
Group	34.24	1	34.24	96.01	.0001****
Sex	0.23	1	0.23	0.64	0.424
Interaction	0.45	1	0.45	1.27	0.265
Residual Error	17.93	50	0.357		

Item #2. catching n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P < .05
Group	35.85	1	35.85	83.81	.0001****
Sex	0.009	1	0.009	0.02	0.884
Interaction	0.009	1	0.009	0.02	0.884
Residual Error	21.39	50	0.428		

Item #3 throwing n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P < .05
Group	31.13	1	31.13	95.29	.0001****
Sex	0.15	1	0.15	0.45	0.504
Interaction	0.04	1	0.04	0.11	0.738
Residual Error	16.33	50	0.327		

Item #4 ball games n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	50.07	1	50.07	83.92	.0001****
Sex	1.12	1	1.12	1.88	0.177
Interaction	0.23	1	23	0.38	0.536
Residual Error	29.83	50	0.597		

Item #5 climbing n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	42.66	1	42.66	65.19	.0001****
Sex	0.009	1	0.009	0.01	0.906
Interaction	0.75	1	75	1.15	0.291
Residual Error	32.72	50	0.654		

Table continues.

Appendix H, Part 1. continued.

Item #6 likes activity n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	48.17	1	48.17	131.36	.0001****
Sex	0	1	0	0	1
Interaction	0.33	1	0.33	0.91	0.35
Residual Error	18.33	50	0.367		

Item #7 fitness n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	32.66	1	32.66	109.29	.0001****
Sex	0.009	1	0.009	0.03	0.86
Interaction	0.75	1	0.75	2.51	0.12
Residual Error	14.94	50	0.299		

Table #8 balance n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	42.66	1	42.66	129.29	.0001****
Sex	0.08	1	0.08	0.25	0.62
Interaction	0.08	1	0.08	0.25	0.62
Residual Error	16.51	50	0.331		

Table #9 plays with peers n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	40.92	1	40.92	104.29	.0001****
Sex	0.009	1	0.009	0.02	0.879
Interaction	0.009	1	0.009	0.02	0.879
Residual Error	19.61	50	0.392		

Table #10 learns skills quickly n = 54

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	52.2	1	52.02	219.79	.0001****
Sex	0.009	1	0.009	0.04	0.844
Interaction	0.009	1	0.009	0.04	0.844
Residual Error	11.83	50	0.237		

End of table

Appendix H, Part 2. Analysis of variance 2 (group) x 2 (sex) on each item of MPRS, grades 4-6.

Item #1 running n = 62

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	60.74	1	60.74	171.69	.0001****
Sex	0.45	1	0.45	1.29	0.262
Interaction	0.06	1	0.06	0.18	0.675
Residual Error	20.58	58	0.354		

Item #2 catching n = 62

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	57.89	1	57.89	171.07	.0001****
Sex	0.001	1	0.001	0.002	0.967
Interaction	0.01	1	0.01	0.04	0.844
Residual Error	19.64	58	0.338		

Item #3 throwing n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	51.71	1	51.71	102.81	.0001****
Sex	0.007	1	0.007	0.01	0.906
Interaction	0.07	1	0.07	0.13	0.721
Residual Error	29.11	58	0.503		

Item #4 ball games n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P < .05
Group	56.88	1	56.88	117.15	.0001****
Sex	0.28	1	0.28	0.59	0.446
Interaction	0.26	1	0.26	0.55	0.46
Residual Error	28.21	58	0.486		

Item #5 climbing n = 55

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	54.57	1	54.57	108.76	.0001****
Sex	0.06	1	0.06	0.11	0.739
Interaction	0.79	1	0.79	1.58	0.215
Residual Error	25.59	51	0.502		

Table continues

Appendix H, Part 2. continued.

Item #6 likes to be active n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P ≤.05
Group	60.02	1	60.02	178.32	.0001****
Sex	1.37	1	1.37	4.08	.048*
Interaction	1.29	1	1.29	3.86	0.054
Residual Error	19.52	58	0.337		

Item #7 fitness n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P ≤.05
Group	54.26	1	54.26	135.41	.0001****
Sex	0.26	1	0.26	0.64	0.425
Interaction	0.24	1	0.24	0.61	0.44
Residual Error	23.24	58	0.401		

Item #8 balance n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P ≤.05
Group	54.26	1	54.26	123.49	.0001****
Sex	2.13	1	2.13	4.85	.032*
Interaction	0.01	1	0.01	0.01	0.98
Residual Error	25.48	58	0.439		

Item #9 plays with peers n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P ≤.05
Group	54.26	1	54.26	104.54	.0001****
Sex	1.02	1	1.02	1.96	0.167
Interaction	0.56	1	0.56	1.07	0.305
Residual Error	30.11	58	0.519		

Item #10 learns quickly n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P ≤.05
Group	72.41	1	72.41	304.95	.0001****
Sex	0.02	1	0.02	0.11	0.751
Interaction	0.01	1	0.01	0.05	0.828
Residual Error	13.77	58	0.237		

End of table.

APPENDIX J

Part 1. Analysis of variance 2 (group) x 2 (sex) on the MDRS, gades 1-3.

Part 2. Analysis of variance 2 (group) x 2 (sex) on the MDRS, grades 4-6.

Appendix J. Part 1. Analysis of Variance 2 (group) x 2 (sex), on the MDRS Grades 1-3.

Item #1 likes physical education n = 54

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	8.96	1	8.96	17.02	.0001****
Sex	0.15	1	0.15	0.28	0.598
Interactions	0.04	1	0.04	0.07	0.792
Residual Error	26.33	50	0.53		

Item #2 enjoys games n = 54

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	22.69	1	22.69	42.09	.0001****
Sex	0.009	1	0.009	0.02	0.896
Interactions	0.009	1	0.009	0.02	0.896
Residual Error	26.94	50	0.54		

Item #3 interacts with group n = 54

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	24.01	1	24.01	51.43	.0001****
Sex	0.33	1	0.33	0.71	0.402
Interactions	0.33	1	0.33	0.71	0.402
Residual Error	23.33	50	0.47		

Item #4 listens and follows instructions n = 54

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	29.63	1	29.53	76.63	.0001****
Sex	1.81	1	1.81	4.69	.035*
Interactions	0.93	1	0.93	2.39	0.128
Residual Error	19.33	50	0.39		

Item #5 effort n = 54

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	42.66	1	42.66	113.95	.0001****
Sex	0.45	1	0.45	1.21	0.276
Interactions	0.08	1	0.08	0.22	0.639
Residual Error	18.72	50	0.37		

Item #6 good running n = 49

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	68.92	1	68.92	278.12	.0001****
Sex	0.139	1	0.139	0.56	0.457
Interactions	0.04	1	0.04	0.16	0.684
Residual Error	11.15	45	0.25		

table continues

Item #7 runs fast n = 49

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	56.29	1	56.29	189.43	.0001****
Sex	0.02	1	0.02	0.05	0.816
Interactions	0.44	1	0.44	1.49	0.229
Residual Error	13.37	45	0.29		

Item #8 agility n = 49

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	64.65	1	64.65	192.81	.0001****
Sex	0.07	1	0.07	0.22	0.641
Interactions	0.09	1	0.09	0.28	0.601
Residual Error	15.09	45	0.34		

Item #9 perform a series of rhythmic actions n = 49

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	62.51	1	62.51	250.85	.0001****
Sex	0.07	1	0.07	0.28	0.601
Interactions	0.007	1	0.007	0.03	0.865
Residual Error	11.21	45	0.25		

Item #10 jumping n = 49

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	47.62	1	47.62	99.97	.0001****
Sex	0.29	1	0.29	0.61	0.441
Interactions	0.68	1	0.68	1.42	0.239
Residual Error	21.44	45	0.47		

Item #11 climbing n = 49

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	45.71	1	45.71	82.08	.0001****
Sex	1.36	1	1.36	2.45	0.124
Interactions	0.77	1	0.77	1.38	0.245
Residual Error	25.05	45	0.56		

Item #12 hoops, ropes, etc. n = 49

Source	Sums of Squares	df	Mean Square	F Ratio	P <.05
Group	59.97	1	59.97	362.85	.0001****
Sex	0.006	1	0.006	0.04	0.852
Interactions	0.53	1	0.53	3.21	0.081
Residual Error	7.44	45	0.16		

table continues

Item #13 large apparatus n = 49

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	43.35	1	43.35	80.59	.0001****
Sex	0.01	1	0.01	0.01	0.926
Interactions	0.11	1	0.11	0.21	0.651
Residual Error	24.21	45	0.54		

Item #14 takes risks n = 49

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	58.16	1	58.16	133.69	.0001****
Sex	0.06	1	0.06	0.14	0.713
Interactions	1.36	1	1.36	3.13	0.08
Residual Error	19.57	45	0.44		

Item #15 Moves with control n = 49

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	57.66	1	57.66	302.98	.0001****
Sex	0.08	1	0.08	0.45	0.506
Interactions	0.27	1	0.27	1.42	0.239
Residual Error	8.56	45	0.19		

Item #16 moves with confidence n = 47

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	69.26	1	69.26	241.31	.0001****
Sex	0.12	1	0.12	0.41	0.531
Interactions	0.63	1	0.63	2.19	0.147
Residual Error	12.34	43	0.287		

Item #17 forward roll n = 47

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	57.28	1	57.28	158.49	.0001****
Sex	0.23	1	0.23	0.63	0.433
Interactions	0.57	1	0.57	1.57	0.217
Residual Error	15.54	43	0.36		

Item #18 comfortable upside down n = 47

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	56.86	1	56.86	203.11	.0001****
Sex	0.16	1	0.16	0.55	0.461
Interactions	1.13	1	1.13	4.03	0.051
Residual Error	12.04	43	0.28		

table continues

Item #19 can bounce a ball n = 47

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	46.21	1	46.21	103.39	.0001****
Sex	0.05	1	0.05	0.12	0.736
Interactions	0.01	1	0.01	0.02	0.902
Residual Error	19.22	43	0.45		

Item #20 ball control n = 47

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	55.38	1	55.38	161.81	.0001****
Sex	0.14	1	0.14	0.41	0.529
Interactions	0.14	1	13	0.39	0.531
Residual Error	14.72	43	0.34		

Item #21 visually track a ball n = 51

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	45.25	1	45.25	118.95	.0001****
Sex	0.14	1	0.14	0.38	0.542
Interactions	0.34	1	0.34	0.91	0.346
Residual Error	17.88	47	0.38		

Item #22 good catching n = 51

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	40.89	1	40.89	91.96	.0001****
Sex	1.41	1	1.41	3.16	0.082
Interactions	0.06	1	0.06	0.14	0.714
Residual Error	20.91	47	0.45		

Item #23 consistent throwing n = 51

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	43.72	1	43.72	101.11	.0001****
Sex	0.13	1	0.13	0.31	0.581
Interactions	0.04	1	0.04	0.11	0.753
Residual Error	20.32	47	0.43		

Item #24 kicking a ball n = 51

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	53.68	1	53.68	180.78	.0001****
Sex	0.02	1	0.02	0.07	0.789
Interactions	0.02	1	0.02	0.07	0.782
Residual Error	13.96	47	0.29		

End of table.

Appendix J. Part 2. Analysis of Variance 2 (group) x 2 (sex), on the MDRS, Grades 4 - 6

Item #1 enjoys phys. ed. n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	25.81	1	25.81	44.88	.0001****
Sex	3.91	1	3.91	6.79	.012*
Interactions	3.78	1	3.78	6.56	.013**
Residual Error	33.35	58	0.58		

Item #2 likes group activity n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	38.72	1	38.72	50.09	.0001****
Sex	3.62	1	3.62	4.68	.035*
Interactions	1.81	1	1.81	2.34	0.132
Residual Error	44.83	58	0.77		

Item #3 interacts with group n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	47.03	1	47.03	62.65	.0001****
Sex	0.62	1	0.62	0.83	0.367
Interactions	0.23	1	0.23	0.31	0.585
Residual Error	43.54	58	0.75		

Item #4 listens and follows directions n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	41.95	1	41.95	67.27	.0001****
Sex	1.37	1	1.37	2.21	0.143
Interactions	0.71	1	0.71	1.14	0.289
Residual Error	36.17	58	0.62		

Item #5 interest and effort n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	52.41	1	52.41	122.19	.0001****
Sex	3.77	1	3.77	8.81	.004**
Interactions	2.66	1	2.66	6.21	.02*
Residual Error	24.85	58	0.43		

Item #6 running n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	62.01	1	62.01	117.56	.0001****
Sex	0.51	1	0.51	0.96	0.331
Interactions	0.58	1	0.58	1.11	0.298
Residual Error	30.59	58	0.53		

table continues

Item #7 rhythmic action n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P<.05
Group	56.15	1	56.15	105.24	.0001****
Sex	0.65	1	0.65	1.21	0.276
Interactions	0.16	1	0.16	0.29	0.592
Residual Error	30.94	58	0.53		

Item #8 good jumping n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	54.26	1	54.26	70.02	.0001****
Sex	0.35	1	0.35	0.45	0.505
Interactions	0.01	1	0.01	0.01	0.985
Residual Error	44.94	58	0.78		

Item #9 good jumping scores n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P<.05
Group	58.06	1	58.06	114.15	.0001****
Sex	0.04	1	0.04	0.07	0.792
Interactions	0.27	1	0.27	0.52	0.472
Residual Error	29.51	58	0.51		

Item #10 Controlled landings n = 62

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	52.41	1	52.41	71.06	.0001****
Sex	0.04	1	0.04	0.05	0.827
Interactions	0.16	1	0.16	0.22	0.642
Residual Error	42.77	58	0.737		

Item #11 A series of actions n = 59

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	43.72	1	43.72	56.23	.0001****
Sex	0.23	1	0.23	0.29	0.587
Interactions	0.05	1	0.05	0.07	0.792
Residual Error	42.76	55	0.78		

Item #12 Large apparatus n = 59

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	42.59	1	42.59	59.68	.0001****
Sex	0.01	1	0.01	0.01	0.923
Interactions	0.01	1	0.01	0.02	0.892
Residual Error	39.26	55	0.714		

table continues

Item #13 Forward roll n = 59

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	56.09	1	56.09	81.97	.0001****
Sex	0.01	1	0.01	0.02	0.899
Interactions	0.49	1	0.49	0.71	0.403
Residual Error	37.64	55	0.68		

Item #14 Moves safely in the gym n = 59

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	51.93	1	51.93	93.52	.0001****
Sex	1.63	1	1.63	2.94	0.092
Interactions	1.56	1	1.56	2.81	0.101
Residual Error	30.54	55	0.55		

Item #15 Fears being upside down n = 59

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	48.24	1	48.24	75.07	.0001****
Sex	1.02	1	1.02	1.58	0.214
Interactions	0.99	1	0.99	1.54	0.221
Residual Error	35.34	55	0.64		

Item #16 Enjoys climbing activities n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	45.83	1	45.83	62.81	.0001****
Sex	1.62	1	1.62	2.23	0.141
Interactions	1.48	1	1.48	2.03	0.161
Residual Error	41.59	57	0.73		

Item #17 Ball control n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	54.72	1	54.72	94.99	.0001****
Sex	0.48	1	0.48	0.83	0.366
Interactions	0.72	1	0.72	1.26	0.267
Residual Error	32.84	57	0.58		

Item #18 Keeps eye on the ball n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	53.03	1	53.03	97.25	.0001****
Sex	0.01	1	0.01	0.01	0.951
Interactions	0.05	1	0.05	0.09	0.771
Residual Error	31.09	57	0.55		

table continues

Item #19 Good throwing style n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	45.42	1	45.42	79.54	.0001****
Sex	1.86	1	1.86	3.25	0.077
Interactions	0.86	1	0.86	1.51	0.224
Residual Error	32.55	57	0.57		

Item #20 Good catching n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	49.25	1	49.25	77.48	.0001****
Sex	0.11	1	0.11	0.16	0.689
Interactions	0.01	1	0.01	0.01	0.939
Residual Error	36.23	57	0.63		

Item #21 Enjoys team games n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	51.56	1	51.56	81.31	.0001****
Sex	0.02	1	0.02	0.04	0.852
Interactions	0.02	1	0.02	0.03	0.855
Residual Error	36.15	57	0.63		

Item #22 Involved in centre of action n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	69.96	1	69.96	127.01	.0001****
Sex	0.75	1	0.75	1.36	0.248
Interactions	0.34	1	0.34	0.62	0.434
Residual Error	31.41	57	0.55		

Item #23 Able to make a play n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	41.41	1	41.41	72.61	.0001****
Sex	0.47	1	0.47	0.83	0.367
Interactions	0.12	1	0.12	0.22	0.643
Residual Error	32.51	57	0.57		

Item #24 Anticipates action n = 61

Source	Sums of Squares	df	Mean Squares	F Ratio	P <.05
Group	48.38	1	48.38	86.22	.0001****
Sex	2.11	1	2.11	3.76	0.058
Interactions	0.81	1	0.81	1.44	0.235
Residual Error	31.99	57	0.56		

end of table.

APPENDIX K

Part 1. Reliability on MDRS, 5-item sub-test.

Part 2. Reliability on MDRS, 19-itme sub-test.

Appendix K, PART 1. Reliability on MDRS, 5-item sub-test, N/ A & PA.

Grades 1-3 Items	Mean		SD		Biserial Correlation	
	NA	PA	NA	PA	NA	PA
1. likes P.E.	3.93	3.11	.27	.97	.33	.74
2. enjoys group play	3.96	2.67	.19	1.0	.54	.77
3. interacts in group	4.00	2.67	.01	.96	.01	.73
4. follows directions	3.82	2.33	.48	.78	.12	.48
5. effort & energy	3.93	2.15	.26	.82	.33	.76

Hoyt Estimate of Reliability. NA = .31, PA = .87 SEm. NA=.55 PA=1.2

Grades 4-6	NA	PA	NA	PA	NA	PA
1.likes P.E.	3.87	2.58	.34	1.1	.89	.79
2. enjoys group play	3.81	2.23	.48	1.2	.92	.86
3. interacts in group	3.77	2.03	.56	1.1	.98	.71
4. follows directions	3.71	2.09	.59	.96	.89	.75
5. effort & energy	3.77	1.94	.49	.89	.86	.87

Hoyt Estimate of Reliability. NA = .96, PA = .92 SEm. NA=.42 PA= 1.2

Appendix K, PART 2. Reliability on !9-Item MDRS.

grades 1-3	Biserial Correl.		grades 4-6	Biserial Correl.	
	NA	PA		NA	PA
1. running	.63	.45	1. lg. apparatus	.77	.64
2. runs fast	.69	.74	2. running	.87	.70
3. agile	.55	.63	3. rhythm	.78	.84
4. rhythm	.39	.47	4. power-jump	.54	.81
5. jumping	.51	.63	5. distance jump	.55	.79
6. climbing	.33	.68	6. jump-landing	.55	.85
7. balls/hoops/etc.	.62	.52	7. action series	.59	.85
8. lg. apparatus	.61	.60	8. fwd. roll	.66	.72
9. takes risks	.53	.73	9. control	.60	.74
10.controlled	.17	.44	10.fears inversion	.58	.76
11.confident	.49	.76	11.climbing	.68	.85
12.fwd. roll	.61	.25	12.ball control	.78	.76
13.fears inversion	.45	.75	13.striking	.78	.80
14.bounce ball	.72	.48	14.throwing	.64	.80
15.ball control	.72	.48	15.catching	.79	.78
16.eye on the ball	.60	.42	16.group games	.86	.87
17.catching	.52	.41	17.part of action	.84	.76
18. throwing	.76	.51	18.series of plays	.88	.84
19.run & kick	.66	.54	19.team player	.82	.67

Hoyt estimate. PA = .91, NA = .91 **Hoyt estimate. PA = .97, NA = .95**

SEm. PA = 2.6, NA = 1.5 **SEm. PA =2.6, NA = 1.5**